



FEDERATION OF MALAYA

ANNUAL REPORT

of the

DEPARTMENT OF AGRICULTURE

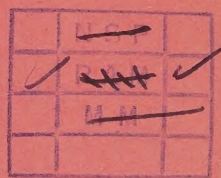
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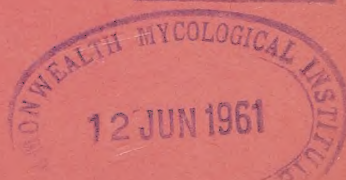
By

A. L. BARCROFT

*Acting Director of Agriculture
Federation of Malaya*



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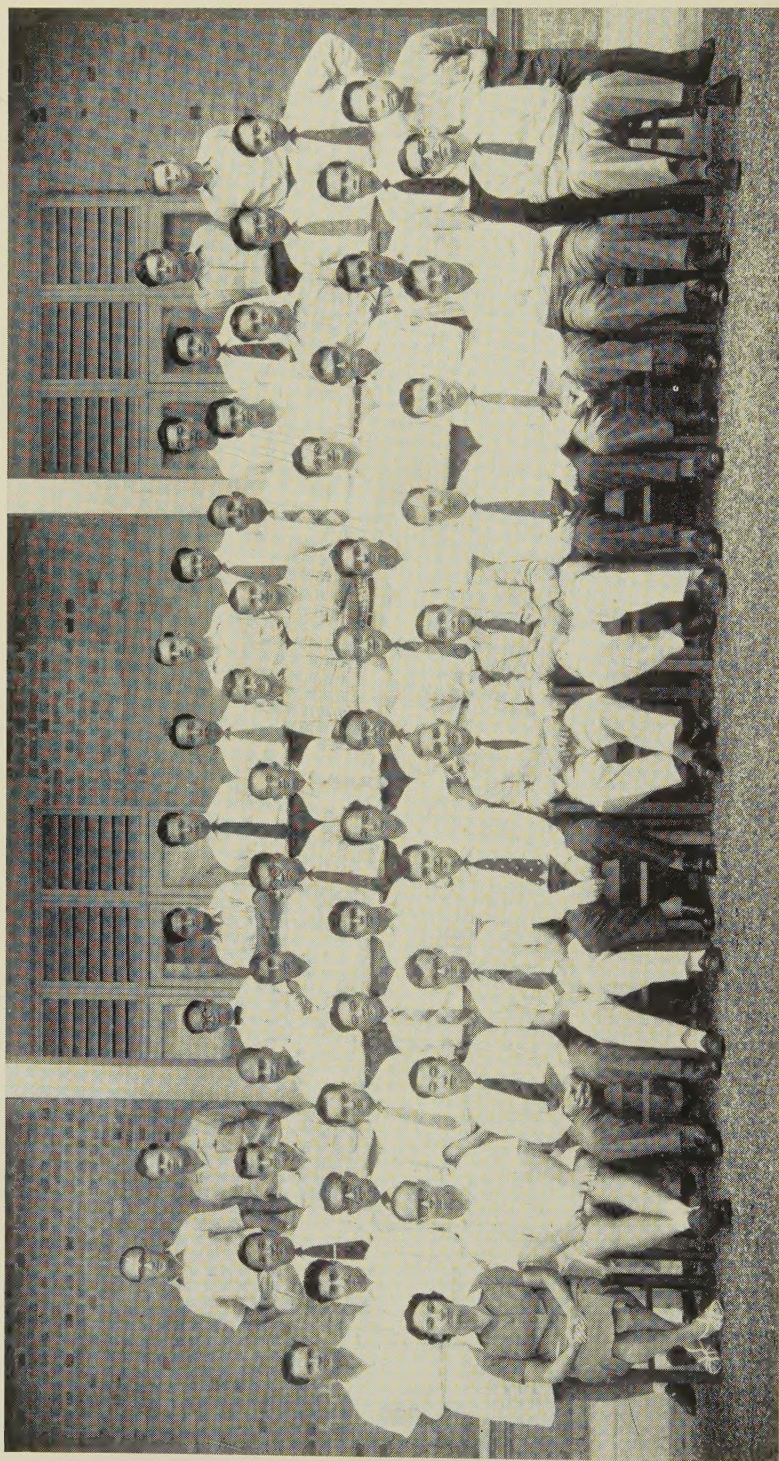
A. L. BARCROFT

*Acting Director of Agriculture
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The Hon'ble Enche' Abdul Aziz bin Ishak, Minister of Agriculture and Co-operatives, with senior officers of the Department of Agriculture, November, 1959.

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ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA, FOR THE YEAR 1959

SECTION I

POLICY AND PROGRESS

A.—POLICY

The return to office of the Alliance Party after the National Parliamentary Elections held in August, 1959, assured the continuation and intensification of the agricultural policy described in the 1958 Report.

2. In broad terms, the agricultural policy of the present Government seeks to attain self-sufficiency in essential foodstuffs, with particular emphasis on rice.

3. Specific policy objectives which are directly the responsibility of the Department of Agriculture are:

(a) To increase both quantitatively and qualitatively existing agricultural produce and to diversify cropping.

(b) To provide agricultural education on as extensive a scale as possible.

The Department is also concerned, but to a lesser degree, with the following broad aspects of agricultural policy:

(c) To ensure security to cultivators.

(d) To improve marketing systems.

(e) To give financial assistance to agriculturists.

B.—ORGANISATION OF THE DEPARTMENT

4. The organisation of the Department of Agriculture has remained as described in the 1958 Report, with the Federal Department responsible for all major agricultural research and investigation work, and for higher agricultural education, and the State Departments for extension activities. In practice, the term "Department of Agriculture" insofar as the Federation of Malaya is concerned embraces no less than 12 Departments—one Federal and eleven State. Though not an ideal organisation from the viewpoints of administrative convenience, effectiveness of direction and co-ordination of activities, experience continues to show that the arrangement does work reasonably well provided close contact is maintained between Departmental staff in the States and the Federal head of the Field Branch who is the co-ordinating officer on extension activities.

5. The concept of one Department of Agriculture to serve the needs of the nation possesses undoubted major advantages and merits serious and careful consideration.

C.—FINANCE

6. The 1959 Estimates for the Federal Department of Agriculture proved, for the most part, adequate to permit continuation of long term research and investigational programmes, and the initiation of certain new lines of work.

7. The current level of expenditure is carefully assessed in relation to the output and capacity of existing staff. As substantial recruitment is anticipated during the course of the next few years, a significant increase in the approved annual provision will prove essential in order to ensure efficiency of effort, maximum output of work, and the greatest benefit to the farmers of the Federation.

8. The importance of possessing a strong and effective Department of Agriculture is readily appreciated by State Governments who, in most cases, continued to provide adequate funds to enable extension activities to be expanded and intensified.

9. Additional funds were authorised in the Development Estimates for the provision of improved facilities in respect of research and investigation work, and agricultural education. Approved projects were, for the most part, completed by the end of the year.

D.—STAFF

10. The number of professional expatriate officers retiring under the Malayanisation scheme during the year was five, of whom four were of superscale rank and experienced officers. Their departure was to some extent compensated by the recruitment of three Malayan officers on completion of higher studies overseas, who were respectively posted to the Field, Agronomy and Education Branches of the Department.

11. Since the implementation of the Malayanisation scheme in July, 1957, 26 expatriate officers have departed on retirement and only 12 Malayan officers have so far been recruited to off-set these losses. Expatriate departures in 1960, so far known, will amount to six.

12. At the close of the year, there were 26 vacancies in the Division I establishment, the percentage strength of posts filled being only 61 per cent of total Division I establishment. Quite understandably in such difficult circumstances output of work has been adversely affected. It is, however, gratifying to be able to record that the responsibilities and functions of the Department continued to be discharged at a high level of efficiency which in itself speaks highly of the efforts and devotion to duty of the remaining officers of all nationalities in the Department.

13. There were 24 vacancies for Agricultural Assistants at the end of the year and it is anticipated that within 2 years all existing vacancies on Federal and State establishments should be filled.

14. The policy of strengthening the establishment of Junior Agricultural Assistants continued and an additional 37 posts were approved by State Governments, representing an increase of nearly

15 per cent over the 1958 establishment figure of 247 posts. The ultimate objective is to secure a ratio of six Junior Agricultural Assistants to every Agricultural Assistant, or to provide one Junior Agricultural Assistant for every 1,000 rural families according to the specific needs of particular States.

E.—PROGRESS IN 1959

15. Satisfactory progress continued to be maintained in the major activities of the Department in spite of a further deterioration in the staffing situation.

16. The main lines of Departmental activity and the progress achieved during the year are summarised as follows:

17. *Rubber*.—On behalf of the Board of Administrators of the National Planting Material Scheme for Smallholders, the Department of Agriculture continued to assume responsibility for the production of approved rubber planting material and distribution to smallholders undertaking replanting and new planting. Distribution from departmental nurseries during the year totalled 355,878 yards budwood of approved clones and 10.88 million clonal seedling stumps.

18. The considerable increase in the number of land development schemes being implemented, and proposed for future implementation, by State Governments will inevitably lead to a greater demand for rubber planting material, particularly in the form of budwood which the Rubber Research Institute are recommending for use in smallholders schemes in preference to clonal seedling stumps. Although the Board of Administrators of the National Planting Material Scheme have foreseen the likelihood of an increased demand and have taken steps to intensify and increase budwood production, the absence of accurate information pertaining to the requirements of individual States prevents the Board from determining whether their proposed programme of expansion is adequate to meet all actual future requirements.

19. *Padi*.—The 1958/59 main season crop was adversely affected in many parts of the country, particularly Kedah and Perlis, by prolonged and severe drought which was responsible for the fall in gross production and average yield per harvested acre. The gross production, equivalent to 420,270 tons of rice, although representing a decrease of about 12 per cent over the record crop obtained in the 1957/58 season, still exceeded the average for the past ten years. Furthermore, the average yield per harvested acre which declined to 326 gantangs per acre from 358 during the preceding season, equalled the average yield per harvested acre for the past ten years. In the circumstances of adverse weather conditions, the yield in terms of both gross production and output per harvested acre is remarkably good and reflects the higher standards of husbandry being practised by padi cultivators, in accordance with the recommendations of the Department which are based on the results of long term research programmes.

20. The 1959 off-season wet padi crop was an all time record in all respects, estimated production being equivalent to 7,719 tons of rice, whilst the average yield per harvested acre was 422 gantangs.

21. In regard to the 1959/60 main season crop, ideal weather conditions were generally experienced throughout the major rice producing areas, from time of cultivation through to ripening, and a bumper crop is confidently anticipated.

22. The long term padi selection and breeding plan progressed satisfactorily and high yielding varieties specially selected for individual States, and in some instances for particular Districts are being distributed to padi planters. Research into the production of improved varieties for off-season cropping has been intensified and a number of non-photosensitive hybrid strains are being tested. The programme of agronomic investigations continued to produce important results, particularly in relation to the manuring and management of padi both in the nursery and the field.

23. State Departments continued to afford priority of emphasis and activity to extension work on padi. Among the padi cultivators there is a growing awareness of the benefits to be obtained from practising improved husbandry particularly the application of fertilisers both in the nursery and the field, the planting of improved varieties, the use of improved cultivation techniques and the more effective control of pests and diseases. The adoption of good husbandry techniques is becoming more widespread and as this process gains momentum, a substantial and continuing improvement in padi production can be anticipated in future seasons.

24. *Coconuts*.—In the simple manurial demonstration plots established on the “beris” soils of the East Coast, the application of organic matter in the form of cattle manure or fish refuse, produced markedly healthy and vigorous growth of young palms. Impressed by the visual response to the application of organic matter, an increasing number of smallholders are adopting this simple but effective technique.

25. The programme of development at the Telok Bharu Station in Perak progressed satisfactorily and should be completed in 1960. A site is being sought on beris soil on the East Coast for the establishment of a new Experiment Station. Apart from coconut investigations, a major function of this Station will be the development of suitable farming systems for the beris soils. It is considered that the integration of crops and livestock within an organised mixed farming system may well be the key to the problem of the economic utilisation of the sandy infertile beris soils of the East Coast.

26. *Fruit*.—Shortage of professional officers continued to hamper the investigation programme, and on this account the establishment of a number of variety and manurial trials had to be postponed. A botanical survey of citrus species growing in Malaya was initiated.

27. Distribution of budded fruit trees from Departmental sources totalled 56,484 representing a decrease of about 11 per cent over the 1958 figure of 63,665. In at least two States, however, substantial supplies of budded fruit tree planting material remained unsold at the end of the year, a factor which has not been taken into account when assessing distribution.

28. Because of the many land development schemes now being established and likely to be established within the next few years, a substantial increase in the area devoted to fruit tree cultivation and in fruit production is certain. Seasonal gluts of fruit in localised area may become a serious problem and organised distribution and marketing will probably be necessary if wastage and consequent hardship to the producer is to be avoided.

29. *Pineapple*.—Transfer to the Malayan Pineapple Industry Board of the responsibility for agronomic and processing research on this crop was completed during the year.

30. The return to small growers from fruit sold to the canneries continued to be inadequate to permit management of holdings in accordance with the principles of good husbandry. Neglect of maintenance was responsible for depressed yields, and numerous holdings were abandoned whilst others were replanted with rubber.

31. *Foodcrops and Vegetables*.—Production of foodcrops and vegetables continued to be given prominent attention by the staffs of the Federal and State Departments. Emphasis was placed upon increasing the efficiency of production particularly through the adoption of improved husbandry techniques including the use of balanced fertiliser mixtures, approved planting material, improved cultural practices, and effective pest and disease control measures.

32. Results obtained from a long term vegetable manurial trial at Cameron Highlands, indicate that the traditionally used prawn dust which is expensive and constitutes an excellent fly breeding medium can be replaced by certain fertiliser mixtures based on Sterameal Black Label which cost less and produce equally effective yield responses.

33. *Oil Palms*.—Exchange of seedling material between Host Estates participating in the co-operative scheme of selection and breeding continued as planned. Eight new field trials were established on Host Estates during the course of the year.

34. Growth of oil palms at the Federal Experiment Station, Jerangau, Trengganu, continued to be very good, and it is interesting to learn that the Federal Land Development Authority are considering the establishment of a smallholders co-operative in the same vicinity.

35. *Tea*.—Observations conducted at the Federal Experiment Station, Jalan Kebun, Selangor, have shown the growth of tea in deep peat soil to be not entirely satisfactory. Tea is also under

observation at the Federal Experiment Station, Jerangan, Trengganu, where growth has proved most encouraging.

36. *Cacao*.—Because of the shortage of professional staff and the low priority afforded to this crop, the Department was unable to give the problem of “die-back” the close, undivided, and skilled attention required. In this knowledge, a request for the services of an expert to investigate the condition of “die-back” was submitted to the United Nations Technical Assistance Bureau.

37. *Livestock and Fodders*.—Remarkable progress into the establishment of stylo (*stylosanthes gracilis*) plots to provide fodder for livestock was made in Kelantan where it is estimated that the area devoted to the cultivation of this fodder now exceeds 600 acres. This extension activity is being pursued in conjunction with the construction of cattle sheds, conservation of padi straw for use as bedding, and the stall feeding of cattle to facilitate the production of high value farmyard manure for eventual application to crops. This basic but effective mixed farming system can easily be adapted to provide for more specialised projects, such as the intensive rearing of beef cattle for slaughter, although to enable such a venture to become economically profitable, certain of the present restrictions relating to slaughter would require to be modified.

38. *Soil Surveys*.—In view of the fundamental importance of soil survey as a prerequisite to the formulation and successful implementation of controlled and phased plans for land development schemes, it is considered that the long term programme of schematic soil mapping currently being undertaken merits high priority in the work of the Department. The information derived from this programme will provide a sound and effective foundation upon which to plan future agricultural development.

39. Schematic reconnaissance maps were prepared in respect of the States of Kelantan and Kedah, whilst arrangements were finalised for the schematic mapping of soils in Perak to be initiated early in 1960.

40. Each State in the Federation now possesses a trained Agricultural Assistant capable of undertaking inspection and soil sampling of small areas proposed for development with rubber planting schemes. Although this arrangement has expedited the prosecution of *ad hoc* surveys, there has been no significant reduction in demands for the services of Soils Division personnel, and this caused disruption of the long term programme of soil mapping throughout the year.

F.—GENERAL

41. In concluding this section of the report I wish to take the opportunity to express my gratitude for the loyalty and devotion to duty demonstrated by all grades of the staff, whose individual and combined efforts have been responsible for the satisfactory progress made during the year.

SECTION II

AGRICULTURE

A.—WEATHER

42. Except for some local variations, the pattern of rainfall throughout the year was normal. At the beginning of the year dry weather prevailed, continuing in some districts the severe drought which had been experienced at the end of 1958. This weather was ideal for harvesting the padi crop although in conjunction with the early onset of dry weather at the end of the previous year, it had an adverse effect on yields particularly on the East Coast.

43. The usual short dry period during July and August was pronounced in some districts and some slight delay in the establishment of padi nurseries was caused. Thereafter until mid-December, rainfall was well distributed but in a few areas above average rainfall caused serious minor floods.

B.—CROP REPORTS

(i) RUBBER

44. Comparative acreages under rubber in the Federation are as follows:

Calendar year	Estates (acres)	Smallholdings (acres)*	Total (acres)*
1952 ...	1,997,000	1,500,000	3,500,000
1953 ...	2,030,000	1,500,000	3,500,000
1954 ...	2,018,000	1,500,000	3,500,000
1955 ...	2,015,000	1,500,000	3,500,000
1956 ...	2,008,000	1,500,000	3,500,000
1957 ...	2,011,000	1,500,000	3,500,000
1958 ...	1,989,000	1,500,000	3,500,000
1959 ...	1,949,000	1,600,000	3,500,000

45. Production figures for the Federation are given in the following table:

Calendar year	Estates (tons)	Smallholdings (tons)	Total (tons)
1952 ...	341,100	241,500	582,600
1953 ...	341,100	231,700	572,800
1954 ...	344,900	240,200	585,100
1955 ...	351,800	285,300	637,100
1956 ...	350,800	273,400	624,200
1957 ...	369,070	268,020	637,100
1958 ...	390,100	272,700†	662,800†
1959 ...	407,648	288,328	695,976

* Estimates only, no accurate figures being available.

† Amended.

46. The Pan-Malayan imports and exports of rubber were as follows:

Calendar year		Gross Exports (tons)		Gross Imports (tons)		Net Exports (tons)
1952	...	910,400	...	339,900	...	571,500
1953	...	847,200	...	277,500	...	569,700
1954	...	915,100	...	344,200	...	570,900
1955	...	994,200	...	362,300	...	631,900
1956	...	983,300	...	365,800	...	617,500
1957	...	1,002,200	...	363,300	...	638,900
1958	...	1,079,900	...	413,300	...	666,600
1959	...	1,202,700	...	458,300	...	744,400

47. The price of International Type I (R.S.S. 1) showed a steady increases throughout the year averaging 101.38 cents per lb. over the whole period. In the four quarters respectively the average prices were: 87.19, 98.27, 103.68 and 116.36 cents per lb. The volume of production of smallholders' rubber during the year was 288,328 tons, an increase of over 15,000 tons above the 1958 production. This is the highest figure recorded during the last 8 years and it is attributed largely to the increased intensity of tapping which resulted from the high rubber prices prevailing during the year. It also reflects the increasing acreage of high yielding rubber now coming into production. Rubber in Malaya is marketed in the form of ribbed smoked sheet (R.S.S.), crepe and preserved latex with small quantities of specialised types such as rubber powder and cyclised rubber. Approximately 59.1 per cent of the rubber was exported in the form of ribbed smoked sheet, 24.4 per cent as crepes of various types and 16.5 per cent as preserved latex. These figures show a considerable reduction in the proportion of crepes exported and a considerable increase in the proportion of preserved latex exported compared with the corresponding figures for 1958 when 30.3 per cent and 11.3 per cent of crepes and preserved latex respectively were exported. Some latex marketing schemes which were introduced in an effort to raise the quality of smallholder rubber and thus increase the value of this crop continued in operation in 1959 but the amount of latex purchased was much less than that of 1958.

48. The following schemes to assist the rubber industry are now in operation:

- (1) Rubber Industry (Replanting) Fund Scheme, Fund "A", for Estates which offers assistance at the rate of \$400 per acre to Estates of 100 acres and above.
- (2) Rubber Industry (Replanting) Fund Scheme, Fund "B", for smallholders which offers assistance at the rate of \$600 per acre.
- (3) Rubber Industry (Replanting) Scheme No. 2 for the administration of Fund "B" which allows smallholders with 5 acres of rubber or less and who also own other land not yet planted, to new-plant up to

the equivalent acreage of their present rubber holding. When the new trees come into bearing, the trees in the old holdings must be cut out and replanted. A grant of \$600 per acre is given in assistance.

- (4) Rubber Industry (Smallholders) New Planting Scheme, 1957, which provides assistance at the rate of \$400 per acre to selected block new planting schemes in which individual participants plant not less than 6 and not more than 7 acres of rubber.

49. Schemes (2) and (3) are the concern of the Administrators of Fund "B" of the Rubber Replanting Scheme under whose direction the smallholders replanting organisation functions. The aim of scheme (2) is to replant a total of 500,000 acres of smallholding rubber in 7 years from the date of the scheme's inception. Of necessity, having regard to the need for staff recruitment and training as well as for publicity in the early stages, the annual target for replanting was graded commencing with 40,000 acres in the first year and ending with 90,000 acres in the final year. The replanting target for 1959 was 90,000 acres and although this target was not reached further good progress was made. Of 32,383 applicants who wished to replant rubber on 130,284 acres, some 21,028 applicants owning 94,948 acres fulfilled the stipulated conditions and were accepted into the scheme. By the end of the year 14,633 applicants owing 71,994 acres had completed the necessary land preparation and received the first payment of the grant. Comparable figures for 1958 are 11,947 applicants owning 61,650 acres of land.

50. The scheme which also allows for replanting with crops other than rubber received 2,753 applications for this purpose covering 6,057 acres of which 1,385 applications covering 4,253 acres were accepted. Compared with 1958 when 1,130 applications were accepted covering 3,178 acres, marked progress in this line was also achieved during the year. From the commencement of the scheme in 1952 up to the end of 1959, the total acreage of smallholdings which has been replanted with high yielding rubber is 297,556 acres. In addition, 19,771 acres have been replanted with approved crops other than rubber which comprised 5,212 acres of fruit, 5,501 acres of coconut, 2,624 acres of coffee, 2,176 acres of padi, 3,276 acres of pineapples, 970 acres of sago and 10 acres of cloves on the Island of Penang. In addition, 8,140 acres of rubber and 336 acres of other crop were replanted as excess acreage giving a total replanted acreage under the scheme of 331,200. At the end of 1959, the total financial outlay amounted to approximately \$114,137,000.

51. A high standard of maintenance is required in replanted holdings in order to ensure that the crops produced are as profitable as possible. The main difficulty in replanting has been found to be lalang (*Imperata cylindrica*) and the complete eradication of this weed is insisted upon. If maintenance in any respect is found to be below standard, part or all of the cash grant can be withheld. The illegal planting of rubber in which unselected

planting materials are mainly used continued as in previous years. Since high yields cannot be expected from these plantings, this contributes a major loss both to the individuals concerned and to the country. Considerable difficulties in land administration are also caused as a result of this illegal planting.

52. The strong demand for new land for planting of rubber continued in 1959 and has been emphasised by the scheme for block new planting of rubber under which financial assistance is given to smallholders provided specific conditions of management are adhered to. Block planting of rubber is also being carried out by the Federal Land Development Authority which is financing several schemes in various States, the largest of which is the Bilut Valley Scheme in Pahang. These schemes, however, are not likely to satisfy in full the demand for land for rubber planting from the smallholders.

53. Seed fall during the year was not heavy but no shortage of clonal seed for the production of clonal seedling stumps was experienced. A total of 5.5 million seeds were planted in nurseries under departmental control, out of which 3.7 million were germinated and planted out at the end of the year. Some 5 million clonal seedling stumps carried over from the 1958 seed fall were also available at the end of 1959 to supplement the 1959 nurseries.

54. Regulations imposing an export duty on rubber planting materials came into force on 1st June, 1959.

(ii) RICE

55. The 1958/59 season produced a reduced crop compared with the previous season. The reduction was caused by late planting in many areas as a result of drought during the planting season in 1958, and the effect of this late planting was further aggravated by the early onset of dry weather in November and December, 1958. The total yield of wet padi was estimated to be 667,000 tons compared with the 1958 figure of 761,500 tons. During the 1958/59 season 859,850 acres were planted of which 817,990 acres (95.11%) were harvested, the balance of 41,860 acres not being harvested due to severe damage caused by drought, late planting and in a few areas by destruction by flooding. The average yield per acre was also lower than the previous year due to the adverse weather conditions. It was estimated to be 326 gantangs per acre compared with the previous figure of 358 gantangs per acre. For the 1959/60 season an estimated 872,900 acres were planted, an increase of some 13,000 acres over the previous season's figure continuing the steady annual increase in acreage planted.

56. With the exception of a few localised areas, conditions up to the end of year were most favourable for padi cultivation and the indications are that a very good crop at least comparable to the record crop obtained in 1957/58 will be obtained. (This forecast has since been confirmed and the 1957/58 yield was exceeded by 89,000 tons in the 1959/60 harvest.) The following

table gives comparative figures for acreages under wet and dry padi together with yields since 1950:

Season	Wet padi		Dry padi		Total padi	
	Acreage (planted)	Yield (tons)	Acreage (planted)	Yield (tons)	Acreage (planted)	Yield (tons)
1950-51 ...	829,000	685,000	47,000	18,000	876,000	703,000
1951-52 ...	790,000	526,000	41,000	16,000	831,000	542,000
1952-53 ...	790,000	684,000	44,000	16,000	834,000	700,000
1953-54 ...	809,000	635,000	37,000	13,000	846,000	648,000
1954-55 ...	843,000	633,000	48,000	19,000	891,000	652,000
1955-56 ...	825,000	644,100	51,000	23,000	876,000	667,000
1956-57 ...	841,000	746,000	55,000	28,000	896,000	774,000
1957-58 ...	850,000	762,000	50,000	25,000	900,000	787,000
1958-59 ...	860,000	667,000	56,000	28,000	916,000	695,000
1959-60 ...	872,900	844,000	61,000	32,000	933,900	876,000

57. Dry padi in Malaya is grown under two entirely different sets of conditions either in semi-wet soil as in Kelantan and Trengganu (padi tugolan, padi taboran or padi tenggala) now known as lowland dry padi; or in dry soil as hill padi now classified as upland dry padi. In the 1959/60 season 33,613 acres were planted with lowland dry padi and 27,586 acres with upland dry padi. The corresponding figures for the 1958/59 season are 33,800 acres and 22,650 acres. It will be observed that the main increase in the total dry padi planted is in the upland crop where an increase of some 5,000 acres is recorded. This increase is largely associated with the opening up of jungle areas for rubber planting in the Federal Land Development Schemes and in rubber block new planting schemes. The main increase in the area occurred in the States of Kelantan, Kedah and Pahang.

58. The area double-cropped with wet padi in 1959 showed an increase of over 50 per cent compared with the 1958 season. The total area planted was 11,640 acres as compared with the 7,920 acres planted in 1958. The total production from the off-season crop amounted to some 12,000 tons of padi, giving an average yield of 422 gantangs per acre, which was 22 gantangs per acre higher than the 1958 average and is the highest on record. The average yield per acre in the off-season is markedly higher than the existing record yield of main season padi which stands at 358 gantangs per acre.

59. The practice of double-cropping which in 1958 was confined mainly to Province Wellesley and Kedah has spread to Kelantan and Trengganu. The progress in increasing the acreage under double-cropping may be observed from the following table:

	1956	1957	1958	1959
Province Wellesley ...	8,360	6,650	7,514	9,850
Kedah ...	600	460	408	1,124
Kelantan ...	—	—	—	470
Trengganu ...	—	—	—	150
Perak ...	—	180	—	45

60. The initial attempt to introduce the cultivators in Kelantan and Trengganu to the practice of double-cropping met

with considerable success and it is confidently expected that this new pattern of rice cultivation in these States will be adopted as a permanent feature.

61. Although the average yield of wet padi for the 1958/59 main season was 32 gantangs below the all-time record achieved in 1957/58, in view of the adverse growing conditions during the season, it is considered that this average yield is reasonably high. The effect of the unfavourable conditions on yield was therefore largely off-set by the increases in yield caused by the adoption of improved husbandry techniques. These include the use of improved seed and fertilisers, and the adoption of good cultural practices. These factors are being appreciated more and more by the padi planters and give indication that further increases in yield and consequent increases in the rice production of Malaya are being steadily achieved.

62. In the double-cropping area of Kedah, the combined average yield per acre from the main and off-season crops was 1,046 gantangs. In Trengganu where yields are generally lower, the average yield per acre for the off-season crop was much higher than that of the main crop and the combined average yield per acre in these areas was 561 gantangs. A high average yield of 505 gantangs was also obtained in the off-season from the double-crop areas in Kelantan where the State average is only 275 gantangs per acre.

63. The average price of first quality imported Siam rice (new crop) in 1959 was \$31.53 per picul, a decrease of \$1.11 cents compared with the average price for the same grade in 1958. The policy of the Government maintained as one of its objectives the highest possible production of rice in Malaya and a reduced dependence on imported supplies.

64. In Kedah the number of tenancy agreements signed under the Padi Cultivators (Control of Rent and Security of Tenure) Ordinance, 1955, further decreased to less than 4,000 (1958, 5,400). This Ordinance is virtually ineffective as it cannot be enforced. No legislation to amend the Ordinance has yet been introduced.

65. The Padi Planters Board, Kedah, expended \$21,050 in the redemption of "*jual janji*", and \$31,820 in the redemption of "*gadaian*". A sum of \$322,068 was expended on the purchase of bendang which was resold to the padi planters and another sum of \$46,766 to purchase rubber land for resale to the farmers. The total sum expended amounted to \$421,704, involving 567 acres of bendang land and 180 acres of rubber land benefiting a total of 170 persons. A Padi Planters Board along the same lines as the Kedah Board was established in Selangor but has not functioned so far. The Pahang Padi Planters Board which was established a few years ago was inactive during the year. The Perlis Padi Planters Board expended \$6,750 for the purchase of buffaloes, \$370 for fertilisers and \$99,652 for the redemption of "*jual janji*".

66. Padi Fertiliser Subsidy Schemes were operated in four States during the year, namely Trengganu, Negri Sembilan,

Malacca and Johore. Although Kelantan discontinued its subsidy scheme in 1959 after seven years of operation, the State consumed the highest ever amount of fertiliser, an increase of 77 per cent over the previous year. This clearly shows that in Kelantan the fertiliser subsidy scheme carried on during the previous years had a marked educational value. It has also created keen competition between the major commercial suppliers, which further enhanced the sale of fertilisers. Total sales in Kelantan amounted to $68,315.5 \times 100$ lb. bags, enough to manure 34,157.75 acres of padi land at 200 lb. per acre or 21 per cent of the State acreage. During 1958 when there was a subsidy of 90 cents per 100 lb. bag the amount consumed was $38,371 \text{ bags} \times 100$ lb. or enough for 12 per cent of the State acreage. It is probable that the fertiliser was applied at less than the recommended rates and that the acreages manured were in fact higher than those quoted.

67. The Trengganu State Fertiliser Subsidy which was in its third year offered fertiliser subsidised at the reduced rate of \$1 per 100 lb. bag. Nevertheless the quantity of fertiliser used was 1,271,050 lb., an increase of 213,770 lb. over the previous season when the rate of subsidy was \$2 per 100 lb. bag. At the recommended rates this was sufficient to fertilise 6,350 acres or 12.7 per cent of the area planted in the State. This increase in fertiliser usage again indicates the marked educational value of fertiliser subsidy schemes.

68. In Negri Sembilan the sale of subsidised *Baja Padi* was not as good as during the two previous years. A total amount of 300,784 lb. was distributed, compared with 588,128 lb. and 490,000 lb. in 1958 and 1957 respectively.

69. In Johore, 100 tons of fertiliser at a subsidy rate of 50 per cent were sold under a State Financed Subsidy Scheme.

70. In Malacca, the fertiliser subsidy scheme was altered to permit part repayment of the subsidised cost to be made after harvest. This is, of course, a more popular method than requiring payment on supply and resulted in an increase of the amount sold to 219,830 lbs., enough to manure 1,691 acres. This is an increase of 600 acres over the previous year's figure.

71. The funds utilised for the Fertiliser Subsidy Schemes were from both the Federal Government's grant of \$10 million for assistance to the padi planters and State Funds.

72. In other States, where no fertiliser subsidy schemes were in operation, the amount of fertiliser used also increased. Throughout the Federation the increase was particularly marked in the use of urea which was used for the first time on a large scale. The amount of urea used for the padi crop was 1,425.5 tons. In addition, it is estimated that 2,323 tons of sulphate of ammonia, 506 tons of double-superphosphate, 4,723 tons of rock phosphate, 462 tons of muriate of potash, 219 tons of Chissophos and 34 tons of ammophos were also distributed. In Kedah and Penang where bat guano has been used traditionally, a total of 12,738 tons were used.

73. The year 1959 marked another step forward in fertiliser distribution to the padi planters as a result of the participation of

the co-operatives through which organisations almost all the urea was marketed. The participation of co-operatives in fertiliser distribution created keen competition between the suppliers which proved to be to the advantage of the padi cultivators, particularly in Kelantan. In this State about 371 tons of the total of 2,874 tons of all fertilisers were supplied by the co-operatives. This method of distributing fertilisers has had a marked effect on fertiliser usage and in conjunction with vigorous publicity, further advances in this field can be confidently expected.

74. Selected padi strains were used in commercial production in Negri Sembilan and Malacca. Serendah Kuning 11 and Serendah Kuning 60 were used in Negri Sembilan and Nachin 39 was used in Malacca. In both States the Department undertook the bulking of the seed and distribution to the planters.

75. Pan-Malayan retained imports of rice and their costs for the last nine years are shown below:

NET IMPORTS OF RICE				
(Pan-Malayan)				
Year		Tons		Value in \$
1951	...	499,000	...	218,740,000
1952	...	423,000	...	198,886,000
1953	...	494,000	...	271,079,000
1954	...	268,000	...	124,812,000
1955	...	484,000	...	164,031,000
1956	...	503,000	...	179,307,000
1957	...	404,000	...	151,583,000
1958	...	462,000	...	178,065,000
1959	...	468,600	...	166,500,000

(iii) OIL PALM

76. Plans for introducing the cultivation of oil palm by smallholders, hitherto exclusively an estate crop, were drawn up for schemes in Johore and Trengganu. These schemes will be run by the Federal Land Development Authority. In Johore arrangements were made with an oil palm estate to produce the planting materials for these schemes.

77. The acreage of land under oil palm together with production figures of palm oil and kernels are as follows:

Year		Planted Acreage		Palm Oil (Tons)		Palm Kernels (Tons)
1951	...	97,000	...	43,000	...	12,000
1952	...	100,000	...	45,000	...	11,000
1953	...	108,000	...	49,000	...	13,000
1954	...	109,000	...	54,000	...	14,000
1955	...	111,000	...	56,000	...	15,000
1956	...	115,000	...	56,000	...	14,000
1957	...	116,000	...	58,000	...	15,000
1958	...	122,000	...	69,000	...	18,000
1959	...	128,500	...	71,000	...	19,294

(provisional)

(iv) COCONUT

78. Coconut, which is the third crop in importance in terms of acreage and is an important smallholders crop is concentrated mainly on the coastal belt of the peninsula. Important coconut areas on the West Coast are in Johore, Selangor, the Bagan Datoh area of Perak, and the coast of Province Wellesley. On the East Coast coconut areas run from Pahang through Trengganu to Kelantan.

79. As a smallholder's crop coconut is next in importance to rubber and rice and on smallholdings it is mainly planted in a mixed stand. It is only on reasonably large estates that monoculture is practised. Coastal alluvial soils with good drainage are the most suitable for this crop. However, owing to the bad drainage condition of soils in some West Coast areas growth and yield have been very poor. With the completion of certain drainage schemes in Johore considerable improvement in growth has been observed. Largely because of the poor growing condition, yields of smallholdings are below those normally obtained on Estates where drainage systems are well maintained. On the East Coast poor growth and yield are mainly due to low fertility of the sandy areas where the coconuts are grown.

80. Production data of coconut, oil and copra and coconut cake in the Federation are as follows:

PRODUCTION (TONS)
FEDERATION OF MALAYA
Copra

Year	Estates	Smallholdings	Coconut Oil	Copra Cake
1953 ...	40,000	112,000	79,000	50,000
1954 ...	40,000	124,000	97,000	62,000
1955 ...	40,000	104,000	95,000	60,000
1956 ...	39,000	115,000	108,000	68,000
1957 ...	36,000	94,000	97,000	61,000
1958 ...	35,000	73,000	79,000	51,000
1959 ...	33,000	92,000	67,000	43,000

81. Although some increase in copra production is recorded, the shortage of supplies to the local mills continued in 1959, resulting in a net import of copra by the country. The net import figures for the last nine years are shown below:

NET IMPORTS OF COPRA

Year	Tons	Value
		\$
1951 ...	11,000	6,606,000
1952 ...	28,000	4,501,000
1953 ...	10,000	2,085,000
1954 ...	67,000	23,446,000
1955 ...	75,000	24,446,000
1956 ...	83,000	29,051,000
1957 ...	72,000	25,517,000
1958 ...	56,000	18,994,000
1959 ...	27,000	11,900,000

82. Copra had long ceased to be an important export commodity, having been replaced by coconut oil. Figures of net export of coconut oil are shown in the following table:

NET EXPORTS OF COCONUT OIL				
Year		Tons		Value \$
1951	...	68,000	...	87,508,000
1952	...	65,000	...	53,966,000
1953	...	61,000	...	58,033,000
1954	...	79,000	...	74,719,000
1955	...	91,000	...	67,554,000
1956	...	103,000	...	73,318,000
1957	...	100,000	...	75,473,000
1958	...	67,000	...	56,039,000
1959	...	37,000	...	39,813,000

These figures show a marked reduction in coconut oil milling compared with previous years.

83. Coconut production in the Federation is directed mainly towards the manufacture of copra for oil extraction. A fairly considerable market also exists for fresh nuts which are used in food preparation by the three main communities in the country. Almost the entire coconut production on large estates goes for copra making, while smallholders nuts are used for copra production as well as to supply the fresh nut market. Good quality copra is invariably produced by the large estates but smallholders copra is usually of indifferent quality. Work of the Department in improving the quality of smallholders copra had been of little effect as insufficient price incentives are provided.

84. On the west coast of Johore large scale drainage work was continued to improve the growing conditions of the crop. As a result of this, marked improvement on the growth of coconut had already become visible. However, this improvement alone cannot be expected to wholly correct the decline in production nor to give a complete remedy for the present low yields in the area, as the low yield is not entirely due to poor growing conditions but also to the low stand of palms per acre and the high proportion of palms of low productivity which cannot be restored to full productivity by ameliorating draining conditions. It appears that a replanting or rehabilitation scheme is required, if any significant increase in productivity is to be achieved.

85. The most damaging insect pest of coconut (*Oryctes rhinoceros*) continued to be destructive particularly in areas adjoining areas where rubber replanting has been undertaken. The pest presents a serious threat to any coconut replanting programme which may be formulated and such a programme to be successful should take the matter of the control of this pest into consideration. Poor field sanitation is primarily responsible for maintaining the beetle population at a destructive level and legislation will be necessary to permit efficient control of this pest.

86. The disease of coconut which was reported in Johore in 1957 has not spread and no further outbreaks were reported.

(v) PINEAPPLE

87. As a smallholder's crop for local consumption pineapple is grown throughout the country. In Johore, Perak and Selangor the crop (Singapore canning variety) is grown as a plantation crop for canning and export by large concerns, as well as by smallholders, mostly on deep peat soils. The crop has enabled the utilisation of this type of soil which is of little use for other forms of agriculture.

88. Total acreages under cultivation during the past six years are as follows:

1954	1955	1956	1957	1958	1959
27,950	34,850	44,780	45,550	44,360	45,540

89. Out of the total areas under pineapple, acreage devoted to the canning variety for the last six years are as follows:

	1954	1955	1956	1957	1958	1959
Estates	8,976	13,876	19,062	19,616	19,322	15,220
Smallholders ...	12,106	16,499	18,974	17,000	13,600	12,200

90. During the year the price for smallholders canning fruit in Johore was 2½ cents per pound. As a result of this low price many holdings were neglected, fertiliser was not used, and in some cases, a start was made towards planting with rubber. The usual winter peak in December did not occur and a major price crisis was therefore avoided. The one cannery in Selangor operated only for a few months during the mid-season harvesting period. Outside this period the smallholders had no major outlet for their fruit.

91. A total of 315 million lb. of fruit was received by the canneries during the year as compared with 317 million lb. in 1958. Out of this, smallholders delivered 88 million lb. compared with 86 million lb. in 1958. Two co-operatives in Johore delivered 14,410,000 lb. of fruit to the canneries during the year. Estate production in 1959 amounted to 227 million lb.

92. Export of canned pineapple from the Federation amounted to 27,139 tons as compared with 28,810 tons in 1958 and 25,960 tons in 1957.

(vi) CACAO

93. The total acreage under commercial cacao amounted to 1,367 acres of which over 1,000 acres are under sole crop in the Jerangau and Landas Estates in Trengganu. The total includes 48 acres under Smallholders Pilot Scheme in Trengganu and some 240 acres under-planted with coconuts in the Bagan Datoh area of Perak.

94. The widespread incidence of cacao die-back has caused a halt in the expansion of this crop and continued to be prevalent in the potential cacao areas of the East Coast. Incidence of die-back however is much less on the West Coast areas where the crop is interplanted with coconuts. The causes of this condition have not yet been determined.

95. The smallholders cacao pilot scheme in Trengganu continued to make satisfactory progress. About 4 acres had to be abandoned because of road improvement works but a replacement area was planted during the year. In view of the uncertain success of the crop the cacao reserves in Pahang which were intended for a further smallholders' scheme were revoked and the area is now being considered for the planting of Oil Palm by the F.L.D.A.

(vii) TEA

96. The total area under tea was 15,982 acres of which two-thirds is highland tea grown at Cameron Highlands in Pahang where yields from the best-managed estates were reported to be 1,000 lb. of prepared tea per acre although some holdings produced as little as 250 lbs. per acre. Lowland tea is cultivated on several estates on the West Coast, in Selangor, Negri Sembilan, Perak, and Johore. Compared with highland tea the yield of lowland tea is considerably higher but this factor is off-set to some extent by the lower quality of the produce.

97. This crop is one of the most profitable in the Federation and Malayan tea obtained good prices on the export market. Price of all grades of Malayan tea on the London market was about \$1.75 lb. local price of Highland tea was about \$2.75 lb. retail.

98. Production figures of made tea are as follows:

Year		Production (lb.)		Exports of Local Tea* (lb.)
1953	...	4,187,000	...	2,172,000
1954	...	4,590,000	...	2,757,000
1955	...	5,306,000	...	2,864,000
1956	...	5,023,000	...	3,633,000
1957	...	5,247,000	...	3,934,000
1958	...	4,878,000	...	4,333,000
1959	...	5,359,000	...	4,760,000

(viii) FOOD CROPS, VEGETABLES AND FRUIT

99. Acreage under food crops was estimated at 115,450 acres, compared with 121,000 acres at the end of 1958. Rice substitutes such as sweet potatoes, tapioca and yams, and the intensive cultivation of vegetables occupied the major portion of this acreage.

100. An established feature in food crop production in Malaya is the utilisation of padi land during the off-season for the production of maize and vegetables. This is practised in Selangor, Malacca, Perak, Penang and Kedah. The main crops produced are maize which are sold as fresh cobs, and vegetables. More than 5,000 acres of padi land were cropped during the off-season.

101. Intensive cultivation of market gardens in the lowlands produced leaf vegetables, cucumbers, bitter cucumber, beans,

* In addition to these quantities, a small amount of Malayan tea is mixed with foreign teas and exported.



Cutting Manila hemp at the
Federal Experiment Station, Serdang

Stripping fibrous ribbons (tuxies) from
the outer surface of a Manila hemp leaf sheath





Decorticating
"tuxies" of
Manila hemp



Hanging up
the hemp fibre
to dry

tomatoes and other vegetables of minor importance. In the Cameron Highlands cabbage, tomatoes, and sugar peas were the main vegetable crops produced. Production of highland vegetables amounted to 290,000 piculs, during the year.

102. Bananas continued to retain their popularity as a catch crop, particularly in areas cleared for the replanting and new planting of rubber. The main producing States are Perak, Pahang, Johore and Selangor.

103. The pattern of kampong agriculture as typified by mixed stands of fruit trees remained. The total area under fruit planted in this manner is estimated at 97,160 acres. In general, the kampong fruit trees are old and are becoming progressively less productive but little replanting of these orchards was carried out. Local campaigns for the replacement of old fruit trees with improved types or with clonal material were conducted and while some progress can be achieved by this means the rate is bound to be very slow if no assistance is provided. A sufficiency of improved fruit planting material is available to meet the existing demand but interest in fruit culture appears to have lapsed.

104. Expansion of citrus cultivation is gaining momentum particularly in North Malaya. Judging by the interest shown by the smallholders in this crop the industry should grow in importance in these areas and expansion in other areas is anticipated.

105. The fruit harvest throughout the country was generally poor.

(ix) COFFEE

106. With the exception of two estates—one in Selangor and one in Trengganu—coffee is a smallholders crop. The area as at the end of the year was 15,350 acres representing an increase of 510 acres over the previous year's figure. Most of the smallholdings are concentrated on the coastal area of Selangor. Coffee is a profitable crop and its further expansion is to be encouraged. However, attention must be paid to the credit requirements and the marketing difficulties of the coffee growers if the growers are to achieve full value for their produce. Some organisation designed to overcome these problems would perhaps enable an export market to be developed as Liberica coffee finds a ready market in Europe.

107. The average price for dried Liberica coffee beans at the beginning of the year was \$145 per picul but dropped to \$130 per picul in June. Towards the end of the year the price rose to between \$150 and \$160 per picul but dropped again to \$145 per picul at the close of the year.

(x) SPICES

108. Spices of importance to the export trade are arecanuts and pepper. Production of arecanut continued to contract but the area under pepper remained unchanged. Chillies, turmeric, ginger, sireh, nutmeg and cloves are produced only for local consumption. A large export/import trade in clove and nutmegs is carried on but this is largely unconnected with local production.

(xi) TOBACCO

109. The estimated area planted during the year was 4,600 acres largely grown as off-season crop on padi land or, in Pahang, as a catch crop on land alienated for rubber. In Upper Perak yield of 12-15 piculs per acre was obtained. Prices varied in different localities, the highest (\$104-\$127 per picul of No. 1 cured leaves) being obtained in Upper Perak. Most of the tobacco grown was the Deli variety but several growers both in Kelantan and Perak are trying Virginia tobacco. An experimental area of 8 acres of Virginia tobacco in Kelantan has shown promising though as yet inconclusive results.

(xii) MANILA HEMP

110. Commercial production of the crop is at present confined to an estate in South Pahang, where the area of 300 acres at the end of 1958 was increased to 500 acres during the year. The fibre is extracted, sorted, graded and baled locally for export to the United Kingdom. The crop which is suitable for Pahang volcanic soils has promise for further expansion.

(xiii) MISCELLANEOUS CROPS

111. Crops of minor importance that were planted include derris, patchouli, citronella, sugar palm, sago, nipah palm and various pulses.

C.—STOCK

(i) CATTLE, BUFFALOES, GOATS AND SHEEP

112. Mixed farming in its true sense is not a feature of Malayan Agriculture, in that cattle are not integrated into any farming system, being kept mainly for draught purposes. In association with rice cultivation, they are allowed to multiply freely and they form a major part of the capital assets of the small cultivators. The production of meat is of secondary importance, the animals normally being sold for this purpose when the owner requires ready cash. Milk production is of much less importance though in areas around the big towns milk production is carried out by Indian cattle and buffalo keepers. Frequently areas are reserved for animal grazing purposes but little use is made as in many cases they are a long distance from the owners dwellings and almost invariably no proper management and fencing is carried out, and they often revert to belukar.

113. The bulk of fodder supply is derived from the grazing of natural growth. Concentrate feeding is not generally known except in the milking herds and the cultivation of nutritious fodder and pasture species is in most areas not practised. However, an exception to this is North East Malaya where a start has been made by cattle owners to grow nutritious fodder plants chiefly *stylosanthes gracilis* which is fed as a supplement to padi straw and to grazing. Some 600 acres of this fodder have now been established in Kelantan. The construction and utilisation of cattle sheds by these cattle owners is also on the increase and in conjunction with fodder crop cultivation, will gradually remove the menace of wandering herds of animals, prevent losses due to theft and reduce the destruction to crops.

114. Sheep are kept in the drier east coast areas though not in large numbers. The standard of husbandry is very low. Goats are common in most areas of the Federation and are generally maintained in better condition than sheep, particularly in respect of housing.

(ii) PIGS

115. There was an expansion in the pig rearing industry during the year as a result of the improved emergency situation and a lesser number of pigs for slaughter were brought in from Thailand. The popularity of Middle White Cross continued to be high and departmental stud boars were made full use of. Almost all the pigs slaughtered, particularly in Malacca, show Middle White blood and it is extremely difficult to find local pigs for breeding purposes which do not have Middle White blood in them. This in the long run will be detrimental to the industry as local animals can be first-class breeding animals and the Department of Agriculture started in 1958 to select a nucleus herd in order to ensure a supply of local pigs in a reasonably pure condition.

(iii) POULTRY

116. Intensive system of production, in batteries or in deep litter is still popular with commercial producers in Johore and Selangor. The depression in prices of local eggs is attributed to the large supplies of cheap eggs from Thailand and the poor demand for day old chicks forced a number of commercial farms to close down. The bulk of egg and poultry production is still derived from the kampongs where birds are kept on the traditional uncontrolled free-range system.

SECTION III

DEPARTMENT OF AGRICULTURE ORGANISATION AND ESTABLISHMENT

A.—ESTABLISHMENT

117. The establishment of the Department is shown in Table I. The number of posts for Professional Officers is 66. In professional posts there were 26 vacancies at the close of the year, made up as follows:

Senior Entomologist	...	...	...	...	1
Senior Plant Pathologist	...	...	...	...	1
Botanists	...	...	...	...	3
Soil Scientists	...	...	...	...	2
Chemists	...	...	...	...	2
Canning Officer	...	...	...	...	1
Agricultural Engineers	...	...	...	...	2
State Agricultural Officer	...	...	...	...	1
Agricultural Officers	...	...	...	...	6
Agronomists	...	...	...	...	4
Senior Lecturers	...	...	...	...	2
Publications Officer	...	...	...	...	1

B.—SENIOR STAFF CHANGES

(i) BRANCH HEAD POSTS

118. (a) *Head Office (Administration)*.—Mr. P. G. Coleman relinquished duty as Acting Director with effect from 12th June, 1959 and Mr. A. L. Barcroft, Deputy Director acted as Director from the same date.

119. Mr. G. S. Keeping, Assistant Director (Field) acted as Deputy Director with effect from 12th June, 1959 and as Director from 10th August, 1959 to 8th October, 1959, in the absence on annual leave of Mr. A. L. Barcroft when he resumed the acting appointment of Deputy Director.

120. Mr. T. R. Dickinson, Senior Agricultural Officer, Grade "A", acted as Deputy Director from 10th August to 8th October, 1959.

121. (b) *Field Branch*.—Mr. G. S. Keeping relinquished duty as Acting Assistant Director (Field) on 11th June, 1959.

122. Mr. T. R. Dickinson, Senior Agricultural Officer, Grade "A", relinquished duty as State Agricultural Officer, Perak, on 13th April, 1959, to proceed on leave to United Kingdom. He resumed duty in the same post on 29th May, 1959, and then relinquished duty on 30th June, 1959, to act as Assistant Director (Field) from 1st July, 1959 to 9th August, 1959. He then acted as Deputy Director from 10th August, 1959 to 8th October, 1959, when he returned to act as Assistant Director (Field).

123. Enche' Mohamad bin Jamil, Agricultural Officer, who was acting as Senior Agricultural Officer, Headquarters, acted as Assistant Director (Field) from 10th August, 1959 to 8th October, 1959, when he returned to act as Senior Agricultural Officer, Headquarters.

124. (c) *Research Branch*.—Mr. J. K. Coulter relinquished duty as Assistant Director (Research) with effect from 25th June, 1959.

125. Mr. F. N. G. Conaty, Senior Research Officer, Grade "A", relinquished duty as Senior Chemist on 21st March, 1959, to proceed on leave. He resumed duty in the same post on 11th May, 1959, on return from leave. On 25th June, 1959, he assumed duty as Assistant Director (Research).

126. (d) *Agronomy Branch*.—Mr. C. Whitehead resumed duty as Senior Agronomist, Superscale "G", on 19th January, 1959, on return from annual leave.

127. Mr. G. I. M. Martin, Agronomist, relinquished duty as acting Senior Agronomist on 19th January, 1959, on the return of Mr. C. Whitehead from annual leave.

(ii) RECRUITMENT

128. Enche' Zawawi bin Hamzah, B.Sc. (Agric.) (Wales) was appointed First-Year Pupil Agricultural Officer (two years' pupillage) on three years' probation with effect from 21st January, 1959.

129. Dr. Ajit Singh Sidhu, B.Sc. (Agric.), Ph.D. (Durham), was appointed Agronomist on 3 years' probation with effect from 7th May, 1959.

130. Enche' Ahmad bin Baba, B. Agric. sc. (N.Z.) was appointed Agricultural Officer (Senior Lecturer) on 3 years' probation with effect from 7th December, 1959.

(iii) RETIREMENTS

131. The following officers retired during the year:

- (1) Mr. P. G. Coleman, B.A. (Cantab.), A.I.C.T.A., Deputy Director of Agriculture with effect from 30th September, 1959.
- (2) Mr. J. K. Coulter, B.Sc. (Queen's University, Belfast), B. Agric. (Queen's University, Belfast), Dip. Agric. Sc. (Cambridge), Assistant Director (Research) with effect from 29th July, 1959.
- (3) Mr. F. B. Brown, B.Sc. (Hons. Botany), Bristol, Dip. Agric. Sc. (Cantab.), Senior Research Officer, Grade "A", with effect from 9th February, 1959.
- (4) Mr. A. Johnston, B.Sc. (Hons. Botany), Aberdeen University, A.I.C.T.A. Senior Research Officer, Grade "A", with effect from 24th January, 1959.
- (5) Dr. J. Dore, B.Sc. (Hons.) London, Ph.D. Southampton, A.R.C.S., Botanist (Plant Physiologist) with effect from 14th May, 1959.
- (6) Mr. H. F. Logan, Administrative Officer, with effect from 13th February, 1959.
- (7) Che Tak bin Haji Daud, P.J.K., A.M.N., Agricultural Development Officer, with effect from 22nd August, 1959.

(iv) ON LEAVE PRIOR TO RETIREMENT

132. The following officer was on leave prior to retirement:

Mr. A. Cumming, A.M.I.B.A.E., Agricultural Development Officer.

(v) PROMOTIONS

133. Mr. A. L. Barcroft, Assistant Director of Agriculture (Field), (Superscale "F"), was promoted to the post of Deputy Director of Agriculture, (Superscale "E"), with effect from 12th June, 1959.

134. Mr. G. S. Keeping, Senior Agriculture Officer, Grade "A", (Superscale "G"), was promoted to the post of Assistant Director (Field), (Superscale "F"), with effect from 12th June, 1959.

135. Mr. J. S. Ure, Senior Agricultural Officer, Grade "B", (Superscale "H"), was promoted to the post of Senior Agricultural Officer, Grade "A", (Superscale "G"), with effect from 1st January, 1959.

136. Mr. F. N. G. Conaty, Senior Research Officer, Grade "A", (Superscale "G"), was promoted to the post of Assistant Director (Research), (Superscale "F"), with effect from 25th June, 1959.

137. Mr. G. W. Arnott, Soil Chemist was promoted to the post of Senior Chemist, (Superscale "H"), with effect from 25th June, 1959.

138. Mr. A. V. Haddon, Botanist, was promoted to the post of Senior Research Officer, Grade "A", (Superscale "G"), with effect from 25th June, 1959.

139. Mr. L. A. Vivian, Agricultural Officer, was promoted to the post of Senior Agricultural Officer, Grade "A", (Superscale "G"), with effect from 12th June, 1959.

(vi) LEAVE

140. Enche' Basir bin Ismail, State Agricultural Officer, Trengganu, was on study leave from 25th August, 1959 to 28th October, 1959, having been awarded a U.S.I.S. Scholarship.

(vii) SECONDMENTS

140A. Mr. T. B. Wilson, Agricultural Economist, Enche Mohd. Tamin bin Yeop, State Agricultural Officer, Malacca, Mr. S. Selvadurai, Agricultural Economist (pupil) and Mr. Lee Yoke Heng, Assistant Statistician, were seconded to the Malayan Agricultural Census Division, Ministry of Agriculture, as Commissioner, Deputy Commissioner and Assistant Commissioners, Census of Agriculture, with effect from 1st January, 1959 (Commissioner) and 1st August, 1959 (Deputy and Assistant Commissioners) respectively.

SECTION IV

WORK OF THE DEPARTMENT OF AGRICULTURE

A.—RESEARCH AND INVESTIGATIONS

141. The investigational work of the Department carried out by the Research Branch showed considerable progress during the past year. Many papers on various aspects of the work on agricultural research, particularly on padi, were prepared for publication or for presentation at F.A.O. Conferences. A full programme of padi breeding and selection was pursued but work on "Penyakit Merah" had to be suspended due to the departure of two plant physiologists, one of whom returned to Canada at the end of his tour of duty under the Colombo Plan. Two Japanese Colombo Plan experts—a plant breeder and an Entomologist—completed their one year tour of duty and submitted reports on their work on padi in the Krian area. Their work is now being continued by two experts from Japan also under the auspices of the Colombo Plan.

142. The work on soil surveys was carried on despite a severe shortage of junior staff in the soils laboratories. A reconnaissance map of Trengganu has been published and field work on both the major upland soil surveys of Kelantan and Kedah has been completed and the final maps and bulletins are in course of preparation. The very careful planning required for the initiation of broadscale reconnaissance schematic mapping of the Federation,

due to start in Perak in February, 1960, has reached an advanced stage and it is clear from the experience gained in Kelantan and Kedah that this type of mapping will yield most valuable results which will be manifested not only in the final reports and maps but in the much more detailed field records which will be filed in Soils Division. The start of the schematic programme has already had to be postponed somewhat because of the demands for *ad hoc* surveys of development schemes, etc., but it is to be hoped that once under way the schematic mapping will be given priority over all other soil survey work. Such a survey carried through to completion will form a very sound basis for all future agricultural planning.

143. The new padi soils/water Research Station at Tanjong Karang has been opened up and work has been started on the construction of the extension to the Soils Division laboratory at Headquarters which will house a spectrographic unit. These extended research facilities have been planned to accelerate and expand our present investigational work on padi soils and on fruit and vegetable preservation. It is, however, essential to have a full complement of staff at all levels in order to carry out this programme effectively.

1.—PADI (RICE)

144. Despite adverse weather conditions in 1958, the 1958/59 botanical experiments were successful, except in Malacca where the indica x japonica hybrid project at Pulau Gadong suffered considerably from both drought and stem-borers. Casualties in the indica x japonica ear rows were very high and data obtained were therefore not reliable enough to permit any selection work to be carried out on this project. Other lines of work at this Station were only slightly affected.

145. The planting of the 1959/60 crop was slightly delayed in most parts of the country due to late rains but crops on the whole have been exceptionally good. Again the indica x japonica hybrids in Malacca suffered heavily from stem borers inspite of repeated efforts at control by fortnightly sprayings with various insecticides.

(i) *Variety Selection and Breeding.*

146. (a) *Variety Trials.*—Completed.

147. A trial comparing three foreign varieties Engkatek, Indai Empati (from Sarawak) and Kao Pudart (from Saigon), and one newly released strain from Malacca, Nachin 39, with the local variety Subang Intan 117, was completed at Kepala Batas Padi Test Station, Kedah.

148. Although the new Nachin selection Nachin 39 gave the best yields over the 3 years it was susceptible to lodging and its grain quality is inferior to Subang Intan 117.

149. Variety variance over error variance was significant but was not significant when tested against variety x years interaction. The increase in yield of Nachin 39 over Subang Intan 117 was only 9 per cent and it is therefore not recommended for this area.

150. Four Subang Intan selections were tested against Radin Ebos 64 (a post war selection) and Radin Che Ali at Sala Kanan Padi Test Station, Kedah. Over the years the best of the Subang Intans (Subang Intan 38) gave 5 per cent more yield than R.E. 64. Although variety variance over error variance is significant, variety variance over variety x year interaction is not. Because of this small increase and the fact that the Subang Intans are also difficult to thresh, no firm recommendation for this variety is given.

151. Five Sarawak varieties, Acheh 62, Bungka Tahun, Indai Empati, Engkatek and Landak were tested against the local standard variety Mayang Ebos 80 at Sala Kanan Padi Test Station, Kedah. Over the years there were no significant differences in yield between the varieties. M.E. 80 gave consistently high yields (average 3605 lbs./acre) in each of the 3 years and the highest average yield over the years. Indai Empati was the best Sarawak variety at this Station, yielding 3537 lbs./acre.

152. Two identical trials comparing seven Sarawak varieties, Engkatek, Indai Empati, Acheh 62, Landak 21, Lasak 56, Tapang 17 and Bungka Tahun, with the local control Siam 29 were completed at Pulau Gadong Padi Experiment Station and Jasin Padi Test Station, Malacca. In both the trials, the local standard variety yielded more than any of the Sarawak varieties (not significant against variety x interaction).

153. (b) *Trials in Progress*.—A trial comparing 8 Sarawak varieties at Telok Chengai Padi Experimental Station, Kedah, has completed two years. There were no "significant" differences in yields between the varieties.

154. A trial to test varietal yield differences of 3 selected varieties (Siam 29, Siam 76 and Radin Ebos 64) one Sarawak variety (Engkatek) and one local variety (Mayang Sesat), has completed 2 years at Hutan Kampong Padi Test Station, Kedah. In the first year (1957/58 season) R.E. 64 significantly outyielded the rest, but in the second year Engkatek significantly outyielded the rest.

155. Two short term varieties (Radin Kling and Haji Haroun) 2 short-medium term varieties (Acheh Puteh and Seriap) and one medium term variety (Siam 29) are under test at Glugor Padi Test Station, Trengganu. Although this trial has completed 3 years, it was decided to continue it for another year because the two short term varieties Haji Haroun and Radin Kling did not give reliable data due to flooding during their nursery period. Statistical analysis of the 3 year results, however, shows that there were no differences in the yields of the 3 varieties, Acheh Puteh, Seriap, and Siam 29 when variety variance was tested against variety x year interaction variance, and that these three varieties significantly outyielded the two short term varieties Radin Kling and Haji Haroun, the highest yield of 3227 lbs./acre being obtained from the variety Acheh Puteh.

156. Six of the best local riverine varieties are being tested in a trial at Kerdau Padi Test Station, Pahang. Over three years

there have been no significant differences in yield between them, but the trial is being continued for a fourth year because drought during the 3rd year invalidated the results.

157. A similar trial at Pahang Tua Padi Test Station, Pahang has completed 3 years, but severe damage by birds has necessitated the continuance of this trial for another year. Statistical analysis of the 3 year results shows that variety variance was not significant when compared with variety x year interaction variance.

158. A trial designed to test 3 Sarawak varieties, Indai Empati, Engkatek, Acheh 62, and 5 Kedah varieties, Seri Bumi, Subang Intan 16, Anak Yatim, Puteh Siam and Siam 29, with a view to finding a suitable variety for the Pulau Langkawi region has been carried out for 2 years. There have been no "significant" differences in yield between the varieties over the 2 years. This trial is being continued for a third year in 1959/60.

159. Seven local Pahang varieties, Serendah Langsat, Serendah Gandar, Anak Gajah, Seri Ayer, Padi Stoi, Lembat and Seri Bumi are being tested against the Negri Sembilan Serendah Kuning Selection, Serendah Kuning 29, at Dong Padi Test Station, Pahang. In the first season there were no significant differences in yield, but Seri Bumi was the highest yielder, giving 2,600 lbs./acre.

160. At Chenor Padi Test Station, Pahang, a trial has completed its first year comparing seven local Pahang varieties which have formerly done well in observation plots in this area with Serendah Kuning 29. The varieties used are: Benang Kemorak, Melek Kuning, Gansar Puteh, Gansar Terong, Gansar Tembeling Merah, Gansar Tembeling Puteh, Seri Bumi and Serendah Kuning 29. No significant difference in yield have yet been detected.

161. In the sandy coastal areas of Kelantan which are represented by the Padi Test Station at Bachok, Cadung Ket, a Saigon variety, has been found in previous trials to give good yields of over 3,000 lbs./acre. In a current trial five Sarawak varieties Engkatek, Indai Empati, Landak 21, Lasak 56 and Acheh 62 are tested against Cadung Ket. The results of the first year's trial indicate that Cadung Ket will significantly outyield all the other varieties in the trial. It gave an average yield of 2,750 lbs./acre. This trial confirms the suitability of this introduced Saigon variety for the area and it has been recommended for extension trials in the 1959/60 season.

162. Sarawak varieties and varieties from other States in the Federation are being tested against the popular local variety at Gerai and Glugor Padi Test Stations, Trengganu. In both these trials the local variety (Morak Sepilai at Gerai, and Lembu Basah at Glugor) significantly outyielded the introduced varieties.

163. Due to the very poor growth in previous years, only four of the F.A.O. Co-operative Rice Variety trials were continued at Telok Chengai in 1958/59. Only two out of the original 69 varieties received from F.A.O. gave results which were comparable to Malayan standards. These are Bam 9 from India and Peta from Indonesia. The trials are being continued in 1959/60 season

after which they will be discontinued as a result of discussion at the 8th meeting of the Working Party on Rice Production and protection of the International Rice Commission, F.A.O.

164. (c) *Variety Survey*.—The five collections of Malayan varieties have been maintained.

165. (d) *Variety Selection*.—Fifteen pure line selection projects have been undertaken. Five of these projects have been completed and seven new strains from these have been bulked up and are being released to farmers. The rest of the projects are in various stages of variety trials or in regional trials. The complete selection programme is given below :

No.	State	Variety	Selections 1958/59	Planted 1959/60	Stage in Selection	Year of Release	No. of Strains
1.	Kedah ..	Radin Ebos	50	50	Project completed Extension trials	1959	1
2.	Penang ..	Mayang Sabatil	48	6	Project completed	Nil	Nil
3.	Province Wellesley	Kontor ..	120	47	Line reduc- tion	—	—
4.	Perak ..	Seraup ..	45	45	Project completed Extension trials	1959	1
5.	Perak ..	Machang	103	23	Variety trials	—	—
6.	" ..	Seri Raja..	210	64	"	—	—
7.	N e g r i Sembilan	Serendah Kuning	48	48	Project completed Extension trials	1956	3
8.	" ..	Serendah Puteh	260	53	Variety trials	—	—
9.	Malacca..	Nachin ..	41	41	Project completed	1956	1
					Extension trials	1958	1
10.	" ..	Siam ..	40	40	Variety trials Extension trials	—	—
11.	Johore ..	A c h e h Puteh	96	96	Line reduc- tion	—	—
12.	Kelantan	Anak Naga	50	50	Variety trials Extension trials	—	—
13.	" ..	Mayang Sagumpal	106	38	Variety trials	—	—
14.	" ..	Padi Tuga- lan	1,002	1,002	3rd year ..	—	—
15.	Selangor..	Radin ..	..	1 acre ..	Foundation plot	—	—

166. (e) *Trials of Pure Line Selections*.—(i) *Radin Ebos (Kedah and Perlis)*. Four of the final series of trials of the Radin Ebos selections which have done well in trials at Telok Chengai Padi Experiment Station are being undertaken in Kedah and Perlis. In all cases R.E. 33 and R.E. 48 gave the best yields and are significantly better than R.E. 64. There are no differences in yield between R.E. 33 and R.E. 48 but R.E. 48 is slightly shorter in height. It would appear from these and former trials that R.E. 33 is an adaptable strain for Kedah and Perlis conditions. As an interim measure, R.E. 33 is recommended until improved Siam or Hybrid strains are available.

167. (ii) *Seraup Selections (Perak, Penang and Province Wellesley)*.—Since the 1953/54 season, the new Seraup Selections have been extensively tried in 11 variety trials in the areas of Penang, Province Wellesley, Krian (North Perak), Sungei Manik (South Perak) and Talang (Central Perak). Results have been excellent and most of the new selections gave appreciable increases in yield over the local standard variety, Seraup Kechil 48, a pre-war selection. The best of the new selections, Seraup 50, has proved to be a very adaptable strain. Results are summarised in the following table:

Area	Completed Years of Trials	Expt. No.	% increase due to				lbs./acre increase				
			Seraup	50	99	24	27	50	99	24	27
Kuala Kurau	3	P. 367		37	30	26	11	998	802	692	307
Simpang Tiga	3	P. 345		39	28	12	27	623	442	196	437
Titi Serong ..	3	P. 344		28	17	21	30	644	400	483	704
Sg. Manik ..	3	P. 369		18	14	6	5	310	238	94	88
Bruas ..	3	P. 368		(-12)	8	15	4	(-187)	119	242	67
Genting ..	2	P. 418		57	31	58	26	702	374	712	321
Sg. Acheh ..	2	P. 419		38	22	—	18	905	511	—	418
Briah ..	2	P. 420		13	—	—	13	319	—	—	320
Bagan Serai	2	P. 421		35	44	23	23	420	530	282	283
Selinsing ..	2	P. 422		34	—	17	31	357	—	177	324
Talang ..	2	P. 452		11	31	9	46	184	528	152	772

168. In all areas, except Bruas, Seraup 50 has yielded considerably more than the standard control Seraup Kechil 48, which if it were replaced by Seraup 50 or one of the appropriate strains entirely, would lead to an estimated total increase of about 9 million gantangs of padi or approximately 15,000 tons of milled rice. Seraup 50 has now been officially released for planting by the farmers.

169. (iii) *Serendah Kuning Selections (Negri Sembilan, Malacca and Pahang)*.—In Negri Sembilan three Serendah Kuning Selections, Serendah Kuning 11, 23 and 3 were released in 1956 after variety trials and extension trials had shown that they are capable of giving 15-18 per cent increase in yield over the local unselected Serendah Kuning in certain areas. Of the three, Serendah Kuning 11 has proved more popular and more adaptable than the other two.

170. However, results of further trials—the final in the series—have shown that Serendah Kuning 60 is capable of giving a further overall increase of 9 per cent over Serendah Kuning 11 and is more adaptable to the varying conditions in the State and this selection is now in trials on farmers' land.

171. In Malacca following the completion of the Serendah Kuning selection trials in 1957/58, Serendah Kuning 30 was recommended for extension trials as a possible replacement for Serendah Kuning 23. (Serendah Kuning 60 did not do well in the Malacca trials).

172. In Pahang Serendah Kuning has been found to be a good variety for the riverine areas of Pahang. The superiority of

Serendah Kuning 23 and 31 over local standard varieties was confirmed by these extension trials and they are now being multiplied for distribution to the farmers. In addition Serendah Kuning 60 has been proposed for extension trials.

173. (iv) *Anak Naga (Kelantan)*.—Variety trials of the Anak Naga selections have successfully completed two seasons. Yields have been good and the selection number 21 has given significantly better yields than the unselected Anak Naga in all trials, as the following table shows:

YIELD OF ANAK NAGA SELECTIONS (lbs./acre)

Station	1957/58				1958/59				Increased yield from A.N. 21	
	Unselected		A.N. 21		Unselected		A.N. 21		1957/58	1958/59
									%	%
Pasir Mas ...	...	2116	2582	...	1499	1788	...	22	19	
Pasir Puteh ...	...	2676	3228	...	3075	3721	...	19	21	
Kota Bahru ...	...	2881	3245	...	2500	3302	...	19	32	
State Average ...	...	2558	3018	...	2358	2937	...	18	25	

174. (v) *Siam Selections (Malacca and Kedah)*.—The final series of trials with those Siam Selections which were not tested in the initial trials, is now under way. In the first series, the selections 16 and 25 showed themselves to be strong strawed and gave significantly better yields than Siam 29. In Malacca, the strong strawed selections Siam 48 gave slightly better yields than the control Siam 29 (not significant statistically).

175. In the first year of the second series in Malacca Siam 48 gave a higher yield than any other selection.

176. Siam 25 is now in extension trials in Kedah and Siam 48 in the coastal regions of Malacca.

177. (vi) *Seri Raja Selections (Perak)*.—Final selections of Seri Raja were tested in comparative yield trials in 1958/59. The results after one year's trial have been most encouraging as more than half of the selections yielded more than the unselected material. The best of the selections gave over 40 per cent increase in yield.

178. (vii) *Machang and Mayang sa Gumpal (Perak and Kelantan)*.—"Machang" selection in Perak and "Mayang Sa Gumpal" in Kelantan have also been put down to formal yield trials in the 1959/60 season.

(ii) Hybridisation.

179. Two groups of hybrid material (indica $\times$ japonica and indica $\times$ indica) are under selection in Malaya. In previous years these two projects were carried at two experiment stations, Telok Chengai Padi Experiment Station in Kedah and Pulau Gadong Padi Experiment Station in Malacca. With the completion of a number of pure line selection projects, more padi test stations now carry hybrid material with a view to developing widely adaptable and possibly non-photosensitive varieties.

180. During the 1958/59 season, progress with the hybrid material at Telok Chengai was very satisfactory but at Pulau Gadong the indica $\times$ japonica hybrids suffered badly from stem borer attack in spite of preventive and control measures. No selection work was done on the hybrid material at Pulau Gadong and the ear rows and progeny plots were planted at this station *in toto* again in 1959/60 season. It is interesting to note, as in previous seasons, the Cuttack hybrids suffered more from stem borer attack than the local hybrids. This probably reflects the fact that they receive extra fertiliser as part of the selection programme aimed at the development of responsive material.

181. At Telok Chengai and Pulau Gadong the best selections from the most advanced generations of both local and Cuttack hybrids have been planted in comparative yield trials.

182. (a) *Indica $\times$ japonica Hybrids*.—At Telok Chengai the most advanced progeny plots were discarded after thorough screening.

183. At Bukit Merah Padi Experiment Station, the 923 selections made by the Colombo Plan expert were planted during the 1959 off-season, of which 350 were retained after harvest for the 1959/60 main season. 13 additional plots of F3 material were also planted. These were in addition to the 12 progeny plots and 329 ear rows previously established.

184. Populations planted during the current (1959/60) season were as follows:

Generation	No. of Ear Rows				No. of Progeny Plots		
	T.C.	P.G.	B.M.		T.C.	P.G.	B.M.
F ₉ ...	39	67	—	...	3	4	—
F ₈ ...	147	302	—	...	34	34	—
F ₇ ...	10	107	679	...	10	14	12
F ₆ ...	—	54	—	...	6	7	—
F ₅ ...	—	—	—	...	13	13	—
F ₃ ...	—	—	—	...	—	—	13
Total ...	196	530	679	...	66	72	25

NOTE: T.C. = Telok Chengai Padi Experiment Station.

P.G. = Pulau Gadong „ „ „

B.M. = Bukit Merah „ „ „

185. The Japanese Colombo Plan experts working at Bukit Merah Padi Experiment Station have made observations of various Japanese, Taiwan and Malayan varieties in Malaya and their results suggest that the Taiwan varieties should be used more extensively in the hybridisation programme.

186. (b) *Hybrids of Local Varieties (Indica $\times$ Indica)*.—The programme of selection has been expanded for 1959/60 and selection plots have been established in Perlis, Province Wellesley, Perak and Negri Sembilan besides those already established in Kedah and Malacca. Seed lines of the best selections have also

been established at Sala Kanan, and Jasin Padi Test Station for comparative yield trials to be carried out in 1960/61 season.

Generation	No. of Ear Rows					No. of Progeny Plots					
	T.C.	P.G.	T.S.	B.L.		T.T.	T.C.	P.G.	T.S.	B.L.	N.S.
F ₉ ...	33	162	—	—	...	—	—	9	—	—	—
F ₈ ...	251	374	—	—	...	—	26	28	—	—	—
F ₇ ...	131	189	—	—	...	14	16	—	—	—	—
F ₆ ...	—	—	—	—	...	—	—	—	—	—	—
F ₅ ...	1172	—	420	175	...	4	47	28	11	16	30
Total ...	1587	725	420	175	...	4	87	81	11	16	30

NOTE: T.C. = Telok Chengai Padi Experiment Station.

P.G. = Pulau Gadong " " "

T.S. = Titi Serong " " "

B.L. = Bumbong Lima Padi Test Station.

T.T. = Tambun Tulang " " "

N.S. = Padi Test Stations in Negri Sembilan.

(iii) *Induced Mutations.*

187. The 5th generation (X₅) progenies of irradiated Siam 29, consisting of 13 lines are being maintained at Pulau Gadong Padi Experiment Station, Malacca.

188. Backcross progenies of irradiated Siam 29 × Normal Siam 29 are being maintained in selection plots at Pulau Gadong. It is hoped to start ear row selection on this project in the near future.

(iv) *Physiology.*

189. A storage experiment has been set up to test the viability of seed under different environments and periods of time. It is hoped to determine the optimum condition of storage for a very long time without deterioration in the viability of seed.

190. Study of the water and soil temperatures in padi fields have been initiated by the Japanese Colombo Plan team at Bukit Merah Padi Experiment Station. In order to determine the time of a day when the maximum and minimum temperatures are reached and also to decide the best time for recording, four series of observations were undertaken in which temperatures were recorded out every hour from 7 a.m. to 7 p.m. It was ascertained that maximum temperatures of air and water were reached between 2 and 3 p.m. and the maximum temperature of soil at one inch depth occurred at approximately 3 p.m. The soil temperature at 4 inches depth reached its maximum between 4 p.m. and 6 p.m. and at 8 inches depth, between 5 p.m. and 7 p.m. The minimum temperatures were presumed to be just before sun-rise.

191. The results obtained clearly indicated that the temperatures of water and soil were higher than the optimum temperature for the growth of padi, particularly during the period of vegetative growth.

192. In order to investigate the possibility to reducing these temperatures to approximate to the optimum, carbon black powder was sprayed on the surface of water at the rate of 20 grm. per 1 sq. meter to intercept the penetration of solar radiation into the water and the effect compared with a control plot. Carbon black powder was applied 3 times at intervals of 3 weeks.

193. Observations on water and soil temperatures were then done thrice daily at 7 a.m., 2 p.m. and 5 p.m. Weeding in the control plot was done twice during the growing period but no weeding was done in the carbon black plot.

194. The results showed that the temperatures of both soil and water were substantially reduced by the application of carbon black particularly during the period from transplanting to heading. But between the heading and harvesting period the temperature in both plots seemed to be identical.

195. The difference of growth between the plants in carbon black and control plot was noticeable. The leaf colour in the carbon black plot was darker than the control plot as soon as one week after transplanting. The dark green colour in the leaves remained until ripening. The heading date of carbon black plot was two days behind the control plot.

196. From the work done so far, it will be seen that the application of carbon black powder in padi fields decreases the water and soil temperatures, restricts the growth of weeds and increases the yield.

197. The oxygen consumption through the roots of a number of padi varieties were determined in a study by the Colombo Plan team from which it was concluded that the oxygen consumption of the longer term varieties is less than that of the short term varieties and this is considered to be a factor in the choice of variety for the various padi regions in the country.

(v) *Insect Pests.*

198. (a) *Stem Borer*.—An insecticidal control experiment using D.D.T. in the 1958/59 season gave disappointing results. Only at one site was there a significant increase in yield due to the treatment and this increase was not sufficient to justify the cost of the treatment.

199. A trial to determine the effectiveness of Rogor 40, Basudin, Dipterex and Oleolindrine against stem borers when applied about four weeks before flowering was carried out at a number of sites. This trial is still in progress. This trial is being duplicated by pot trials conducted on the same lines. Another pot trial is also in progress to confirm Wyatt's findings that the most effective control can be achieved by applying the insecticide four weeks before first flowering.

200. The Malaya-wide survey of stem borer damage at flowering was continued in the 1958/59 season when the mean percentage of bored tillers was recorded as 14.2 in Krian and 1.4 in Kelantan. In the 1959/60 season a more accurate survey was

initiated in Kedah, recording being done at randomly selected sites throughout the padi growing areas.

201. The fluctuation in stem borer population was studied at Parit Satu Padi Test Station, Selangor, where four species of stem borer were recorded. It is hoped to continue this study for a number of years.

202. A further pot experiment is in progress to compare the effectiveness of Endrin, Dieldrin, Rogor 40, D.D.T., B.H.C., Diazinon and Malathion against stem borers. This indicates that endrin-control was associated with significantly increased yields while Malathion and D.D.T. were not. The use of Endrin in Malaya is, however, restricted by law because of its toxicity to mammals.

203. On the advice of the Japanese Colombo Plan Entomologist, Dipterex was tested in a pot trial. This trial indicated that there was a possibility of controlling young stem borers with this insecticide although older ones are less susceptible.

204. The Japanese Colombo Plan Entomologist is now working on the following projects:

- (a) to find the most suitable insecticide and method of application of treatments for the control of the padi stem borers.
- (b) to determine whether or not power driven sprayers can be used in kampong padi holdings.
- (c) to determine the number of applications necessary for controlling stem borers by power driven sprayers.
- (d) to observe the behaviour of padi stem borers in Kampong holdings.
- (e) to determine the effects of insecticides on the padi stem borers under laboratory conditions.

205. (b) *Padi Field Crabs*.—These crabs caused considerable damage to padi in Kedah and Perlis by destroying the young padi seedlings. Its life history and habits are, however, not known and as a preliminary to investigation of control measures a study of its life history is being undertaken.

(vi) *Diseases*.

206. The only investigation carried out during the year was directed towards developing a suitable technique for infecting plants with the fungus under laboratory conditions. This indicated that high humidity and the use of a spreader with the inoculum increased the effectiveness of the inoculum.

2.—OIL PALM

(i) *Breeding and Selection*.

207. (a) *Breeding*.—Very few pollinations were made at Serdang during the year and most of these were not directly in connection with the breeding programme.

208. The distribution of seedlings by Host Estates participating in the co-operative Breeding Scheme was continued.

209. New field trials were planted on Estates as follows:

Host Estate	Trial No.	Material Under Test
Klanang Bahru	0.57	16, miscellaneous progenies (including commercial D.T. progenies as well as melanococca hybrids and mantled teneras).
Ulu Remis ...	0.50	5 "Short" dura progenies
	0.51	4 tenera and 1 dura progenies
	0.52	Selection block of inbred "short" palms.
Johore Labis...	0.53	8 "short" dura progenies
	0.54	10 Miscellaneous dura and tenera progenies.
	0.55	Selection block of inbred short palms.
Jendarata ...	0.56	12, miscellaneous (includes commercial tenera, melanococca hybrids and virescens duras).

210. (b) *Selection*.—Palms in the old progeny trials at Serdang declined in yield.

Experiments 0.1 and 0.2 Elmina dura Lines—Federal Experiment Station, Serdang (Planted 1937/38)

TABLE I

Experiment No.	Field	Progeny	Yield of F.F.B. (tons/acre)		Mean Bunch Weight (lbs.)	
			1958	1959	1958	1959
0.1	... 4 ...	E. 45 ...	3.9	2.6	31.7	34.0
		E. 93 ...	2.5	2.3	23.7	23.7
		E. 200 ...	4.5	3.0	43.4	44.9
		E. 211 ...	6.2	4.0	41.0	35.9
0.2	... 4 ...	E. 97 ...	3.3	1.9	23.7	21.5
		E. 152 ...	3.1	1.9	33.9	30.2
		E. 207 ...	3.3	3.2	43.8	46.8
		E. 216 ...	3.0	3.1	32.3	35.9
		E. 268 ...	5.4	3.6	42.5	39.1
Unreplicated	4 ...	E. 268 ...	4.9	3.4	39.6	33.0
		E. 366 ...	5.5	4.1	36.5	33.7
		E. 120 ...	4.6	3.8	37.3	35.3
		E. 206 ...	3.9	2.2	40.3	31.2
0.3	... 3a ...	E. 206 ...	6.2	5.7	47.6	43.5
		E. 152,				
		206 ...	6.9	4.8	53.5	48.3
		E. 206,				
		268 ...	6.2	4.1	53.5	49.2

211. The number of bunches harvested from trial 0.8 at Federal Experiment Station, Jerangau, was reduced but an increase in bunch weight more than compensated for this. However, bunches are still rather light and although this appears to be

through inadequate pollination, counts of male and female flowers do not entirely support this theory.

Experiment 0.8 Dura Progeny Trial—Federal Experiment Station, Jerangau (Planted November, 1952)

TABLE II

Origin	Pedigree	Yield of F.F.B. (tons/acre)			
		1958	1959	Mean	
Estate A ...	Soc. 6346 ...	6.91 ...	7.67 ...	6.10	
	Soc. 1034 ...	7.43 ...	8.23 ...	6.53	
Estate B ...	220/4×261 ...	8.07 ...	9.56 ...	7.13	
	174/12×E. 63/17 ...	7.67 ...	9.23 ...	7.44	
Serdang ...	47/2×25/5 ...	8.42 ...	8.69 ...	7.16	
	...	8.12 ...	7.95 ...	6.89	
S.E. ...	—	±0.46 ...	±0.60 ...	—	

212. The collection (0.4) of Dumpy-backcross palms growing on the coastal clay of a Selangor Estate and planted in May, 1951, has now reached maturity and yields have been almost constant for the last 3 years. Bunches continue to increase in weight but the set of fruit on bunch is not satisfactory.

213. The one semi-dumpy×semi-dumpy progeny (14.2×10.8) gave a much improved yield.

Experiment 0.4 Dumpy-backcross progenies planted May, 1951

Progeny	Yield of F.F.B. (tons/acre)							
			1957		1958		1959	
<i>Semi-Dumpy</i> × <i>Dumpy</i> —								
12.3 × 1.1	...	...	...	9.5	...	8.8	...	9.4
14.2 × 1.1	...	...	...	10.5	...	9.4	...	10.5
12.3 × 1.7	...	...	...	10.5	...	10.2	...	9.7
14.2 × 1.7	...	...	...	10.3	...	10.7	...	11.1
12.3 × 3.5	...	...	...	9.7	...	9.7	...	9.6
14.2 × 3.5	...	...	...	10.1	...	9.3	...	10.2

Semi-Dumpy×*Semi-Dumpy*—

14.2×10.8 ... 8.7 ... 8.0 ... 9.7

214. Other dura trials planted on an estate in Perak showed little change in yield during 1959. The Dumpy palms in Experiment 0.5 showed an improved bunch size (average 27 lbs.).

Experiment 0.5 Dumpy dura progenies planted November, 1951

Progeny	Yield of F.F.B. (tons/acre)	
	1958	1959
1.7×3.5 ...	5.7 ...	5.8
3.5×1.7 ...	6.4 ...	6.9
2.4×1.7 ...	6.3 ...	6.1
3.5×2.4 ...	5.4 ...	6.4
3.4×2.4 ...	5.7 ...	6.2
S.E. (12) ...	±1.2 ...	±0.3

215. In trial 0.17, on an estate in Selangor, the normal dura palms continued to yield more than the Dumpy duras.

Experiment 0.17 Normal versus Dumpy dura
(Planted March, 1953)

		Yield of F.F.B. in 1959 (tons/acre)		Mean Bunch Size (lbs.)
Normal dura	...	5.8	...	23
Dumpy	...	3.5	...	22
S.E. (3)	...	± 0.3	...	—

216. The tenera palms in experiment 0.19 at Federal Experiment Station, Jerangau, yielded more fruit than the dura palms in trial with them. This was due both to an increased size of bunch and weight of bunch.

Experiment 0.19 Tenera versus Dura

Federal Experiment Station, Jerangau (Planted December, 1953)

				F. F. B. (tons/acre)	
				1958	1969
Dumpy dura (2.4) × Nigerian pisifera	...	...	...	8.0	10.1
„ „ (1.7) × Serdang pisifera (27B)	...	...	...	6.9	8.7
„ „ (3.5) × „ „ (27B)	...	...	...	8.4	10.1
Semi-Dumpy dura (12.3) × Dumpy dura (3.5)8	...	...	...	6.9	8.4
„ „ (12.3) × „ „ (1.9)	...	...	...	5.2	6.7
„ „ (12.3) × „ „ (1.7)	...	...	...	6.7	7.7
S.E. (20)	...	...	...	+0.5	+0.6

3.—COCONUTS

(i) *Breeding and Selection.*

217. At the Federal Experiment Station, Telok Bahru, the five progeny trials were planted with final supplies during the year. Attack by *Oryctes rhinoceros* continued to be severe but no further supplies will be planted as the oldest palms are now coming into bearing.

218. No attempt was made to plant the collection of selected estate material in a formal trial but "control" rows of seedlings from Port Swettenham palms were included.

219. This foundation stock now includes coconuts from:
Federal Experiment Station, Port Swettenham.
Kuala Bernam Estate.
Sungei Bernam Estate.
Blenheim Estate.
Jugra Land and Sarey Estate.

(ii) *Pests.*

220. Laboratory tests were carried out to discover the most effective insecticide for controlling *Oryctes* grubs. Five insecticides were used on half to full grown grubs in sawdust and the following

encouraging results were obtained. The percentage kill was recorded after 9 days.

(a) Malathion	...	...	0.5 % a.i.	58.3 %	&	83.3 %
(b) Basudin	...	...	0.5 % a.i.	91.7 %	&	100 %
(c) Endrex	...	...	0.5 % a.i.	91.7 %	&	100 %
(d) Oleolindrine	...	...	0.5 % a.i.	91.7 %	&	100 %
(e) BHC w.p.	...	...	0.5 % a.i.	—		100 %
(f) Control	...	...	0	—		8.3 %

221. A laboratory test was also carried out to study the effect of certain chemicals on *Oryctes* beetles. The chemicals were applied on portions of oil palm stems, which were then caged with adults collected in the field. Results show that BHC and Basudin gave 100 per cent kill after 24 hours while endrex and dioldrex produced 50 per cent mortality after the same period.

222. The trap breeding pit experiment was repeated and concluded in an estate in Selangor with the object of controlling *Oryctes* by means of insecticide treated trap breeding pits. Of the three concentrations of BHC (0.5 per cent gamme BHC) and 0.5 per cent Oleolindrine used in this experiment, it was found that 0.5 per cent gamme BHC gave the best result (63 per cent kill) but this was considered not good enough to control *Oryctes* population in the field.

223. A field test was conducted during 1959, at the Coconut Experiment Station, Telok Bharu, to observe whether certain insecticides have any effect in reducing *Oryctes* attack. The insecticides were BHC, Dieldrex Extra, Endrex, Basudin, Napthalene and p-dichlorobenzene, and these were applied to the central leaf bases of 3 year-old palms at three weeks' intervals. Monthly records of *Oryctes* attack were taken from May (commencement of the experiment) to November, 1959 and show insignificant differences in the pest attack between plots. Throughout the trial attack remained below 10 per cent in all plots including the control except in p-dichlorobenzene plots where it rose slightly above 10 per cent in August and September only. As these results are inconclusive is proposed to repeat this experiment at a later date.

224. Investigations into the unknown coconut "disease" in the Batu Pahat area of Johore were carried out by the Entomology division. Samples of five diseased palms were examined to determine whether or not the disease was caused by nematodes. Extractions were made from all samples and microscopic examinations showed that nematodes in an appreciable number were present in samples taken from one palm only while extractions from samples of the remaining palms showed few or no nematodes. The conclusion drawn was that the disease was not caused by nematodes.

4.—CACAO

(i) Selection.

225. "Die-back" continued to be the most important single factor limiting the yield of cacao in selection trials. There is no

clear-out resistance, immunity or tolerance to the disease amongst the genetic stock available although it does seem that, when the condition is not severe, the most vigorous plants are able to make some good growth.

226. At Federal Experiment Station, Jerangau, hybrids of Upper Amazon crossed with either Trinitario, Criollo or Amelonado are usually very vigorous compared with other seedlings but cuttings of I.C.S. clones and Upper Amazon (Malayan) selections also showed satisfactory growth.

Cacao Progeny Trials—Federal Experiment Station, Jerangau. Approximate Yield of Dry Cocoa (lbs./acre).

Progenies		Trial 1 Planted Nov., 1955	Trial 2 Planted May, 1956	Trial 3 Planted Aug., 1956	Trial 4 Planted Nov., 1956	Trial 5 Planted Dec., 1956	Trial 6 Planted Mar., 1957
Amelonado	×	32	0	6	0	0	0
S.I. Trinitario	×	18	6	10	3	0	2
"	×	42		0	3	0	0
					0	23	0
						0	
						1	
S.I. Trinitario	×	22	22				
"	×	211					
"	×	87					
S.I. Trinitario	×	292	68		40	13	1
"	×	281	97		18	4	0
"	×	144			129	1	
"	×				209	19	
"	×		84				
"	×		1		28		
S.C. Trinitario	×	17	7				0
"	×	7	3				
S.C. Trinitario	×	25			1	0	0
"	×						0
Upper Amazon	×	363	10		1		0
"	×		6				
"	×						

Upper Amazon × Criollo	...	285	7	169	—	56	—
Upper Amazon × Upper Amazon	—	48	160	19	20	1	
	—	87	118	113	12	18	
	—	—	96	138	—	0	
	—	—	39	—	—	—	
	—	—	127	—	—	—	
	—	—	102	—	—	—	
	—	—	61	—	—	—	
	—	—	58	—	—	—	
	—	—	81	—	—	—	
	—	—	22	—	—	—	

(NOTE.—except for the Amelonado control, different progenies are planted in each trial. Trees are planted 8'×8' apart on the square in plots of 4×3 trees each. There are five replications within each trial).

S.C.=self compatible.

S.I.=self incompatible.

227. At Serdang, there is little doubt that, had it not been for "die-back", there would have been heavy crops during 1959. As it was, the yields were better than those for 1958 but still generally poor. Most of the crop was harvested in March-April.

228. In the trial of Indonesian Trinitario (C.6), the control plots of Amelonado seedlings still gave the most crop although the appearance of the trees was very poor. The Malayan Trinitario in trial C.5 appears to be slightly more resistant to die-back than Amelonado and this is reflected in the crop.

Experiment C.6—Indonesian Trinitario, Federal Experiment Station, Serdang, Planted September, 1950

Progeny			Approximate Yield of Dry Cocoa (lbs./acre)		
			1957	1958	1959
Trinitario	Gt. 8	...	659	...	351
	Dr. 1	...	617	...	391
	Pr. R.	...	667	...	272
	Pr. G.	...	737	...	254
	Suz	...	634	...	256
Amelonado	...	...	1,022	...	310
Field Mean	...	...	723	...	306
					288

Experiment C.5—Malayan Trinitario, Federal Experiment Station, Serdang, Planted March, 1950

Progenies			Approximate Yield of Dry Cocoa (lbs./acre)		
			1957	1958	1959
Trinitario	(near Criollo)	...	511	...	306
	(Forestero)	...	377	...	191
Amelonado	...	...	501	...	178
Field Mean	...	...	463	...	225
					348

229. The small plot of 39 Upper Amazon seedlings gave a much improved crop during the year. This isolated plot shows scarcely any symptoms of "die-back".

Upper Amazon Seedlings, Federal Experiment Station, Serdang,
Planted October, 1952

	1957		1958		1959
Total Number of pods harvested	615	...	204	...	767

(ii) *Breeding.*

230. Controlled pollinations were made only in order to produce a few hybrid pods for the Department of Agriculture, North Borneo and for Jerangau Estate.

231. No further trials were established although a two-acre site has been cleared and planted at Federal Experiment Station, Jerangau, with legume shade and ground covers in preparation for a new trial to be planted under refined techniques in 1960.

(iii) *Nutrition.*

232. In continuation of experiments on the cause of "cocoa die-back" disease a number of small scale trials were carried out during the year to test the effect of various nutrient solutions on the growth of coca seedlings growing in pots of soil from Jerangau.

233. In the first trial it was found that the following elements, or combinations of elements, had a highly positive significant effect on plant weight:

P, K, L, PL & NL (L=Ca+Mg).

234. All plants which received Nitrogen as Sodium nitrate showed symptoms of "leaf-scorch" (See Bulletin 107) and these were particularly severe in the absence of lime.

235. In a subsequent experiment it was demonstrated that the nitrogen "carrier" was relatively unimportant but calcium alone gave slightly better growth than when mixed with Magnesium as in the first experiment.

236. It is of interest to note that the level of calcium applied in these experiments was sufficient to raise the soil pH from 3.8 to 8.2.

237. A previous field observation indicated that to prevent leaf-scorch of seedlings, the soil used for basketing should be exposed for a few weeks prior to use. Formal experiments designed to test this observation showed that sun-drying for two weeks led to severe leaf-scorch but soil which had been alternately wetted and sun-dried five times during the 2 weeks gave healthier seedlings than fresh soil.

238. Current experiments are intended to establish the optimum ratio of calcium and nitrogen fertiliser dressings and to investigate the effects of artificially leaching the soil with the equivalent of 30" of rainfall.

(iv) *Insect Pests.*

239. *Helopeltis*.—Five tests have been carried out with the object of finding out the most efficient and economic method

of controlling *Helopeltis* attacking cacao. Three of the tests were conducted at the Federal Experiment Station, Serdang, and two at Kampong Awah, Pahang. General conclusions drawn from this experiment are as follows:

- (1) No differences in the efficiency of the various insecticides used were detected.
- (2) Evaluation on an experimental scale of individual insecticides is rendered very difficult due to the mobility of the insect, *Helopeltis theobromae*, allowing only overall intensity of infestation to be estimated thus masking the effectiveness of individual insecticidal treatments.
- (3) After 5 applications of insecticide, attack recurred after 4 to 5 months whereas after only two applications attack recurred after 2 months.
- (4) "Motoblo" spraying controlled the pest for 22 weeks whereas fogging controlled the attack for only 8 weeks.

(v) *Diseases.*

240. (a) *Die-back.*—Experiments continued to ascertain whether the fungi *Botryodiplodia theobromae* and *Fusarium decemcellulare* are associated with die-back on weak unthrifty plants. From these it was concluded that die-back could be induced on plants grown under water stress or in sand culture minus calcium without involving a pathogen. The pathogenicity of the two fungi was therefore not proved.

241. (b) *Black Pod.*—Black pod of cacao was observed for the first time in Malaya in Federal Experiment Station, Serdang, in November. The disease was confined to the cacao trees in the fruit nursery area where very low branches and dense shade prevail. In only one instance was a *Phytophthora* infected pod obtained from a field plot. Control measures in force for the wet spell consist of Perenox sprays at 10-day intervals and twice weekly inspections for black pod.

5.—PINEAPPLE

(i) *Processing.*

242. In an experiment to ascertain if any differences in the quality of canned pineapples can be caused by using different portions of the fruit, the top half and bottom half of the fruits were canned separately in 12 ozs. cans using standard sugar syrup. After storage better colour and a slightly better flavour was recorded from the bottom portions but the differences in the quality of the two packs was slight.

243. In an investigation designed to improve the keeping quality of concentrated pineapple juice, a series of samples were prepared containing 0 (control); 200; 400; 600; 800 and 1,000 p.p.m. sulphur dioxide added as sodium pyrosulphite (metabisulphite). A set of three samples has been shipped to the Tropical Products Laboratory in London for testing while a duplicate set is being stored in Kuala Lumpur and will be tested for sulphur dioxide content.

244. A small experiment on the deep freeze preservation of pineapple chunks was laid down. Fruits were collected from the United Malayan Pineapple Cannery and Juice and chunks prepared from them. Chunks and frozen chunks were put into polythene bags and samples prepared with straight juice, syrup juice (containing 30 per cent by weight of sugar added to juice), and 30 per cent syrup respectively. Some samples were stored in the deep freeze at 5°F and others were brought to Headquarters in Kuala Lumpur for testing. Samples prepared in straight juice were rather insipid to taste.

(ii) *Pests and Diseases.*

245. An experiment started in 1958, to determine whether mealy bug wilt is caused by the feeding and saliva of mealy bugs or by a virus transmitted by the mealy bug, was completed during the year. The results were inconclusive.

6.—TEA

246. *Insect Pests.*—Advice for the identification and control of the common “red coffee borer” *Zeuzera* sp. was requested from Negri Sembilan. The stem-borer, *Zeuzera* sp. and three other leaf-eating caterpillars, *Asura* sp., *Amsacta lactinea* and *Utethesia* sp., were reported to be causing some damage to tea in an estate in Negri Sembilan.

7.—FRUIT

(a) *Citrus.*

247. *Survey.*—A Botanical survey of citrus species growing in cultivated or semi-cultivated conditions has been initiated. Collections were made in all States except Kelantan, Trengganu, Pahang and Perak, and these will be visited during 1960.

248. A substantial quantity of pressed and pickled herbarium material has been collected, and in addition living seed has also been collected so that the juvenile characteristics of the seedlings can be observed. This seedling material has already demonstrated that a variety normally planted commercially from seed (*Limau Chembol*) does, in fact, throw an appreciable proportion of off-types (perhaps 5%).

249. The suitability of certain likely seedling types for use as root-stocks is being tested.

250. *Fruit Colour and Quality.*—An attempt is being made to establish objective tests of fruit quality for future selection work.

251. It has been demonstrated that Malayan fruit, which is generally green or only slightly coloured, can be turned to an attractive orange colour by a simple acetylene gassing technique.

252. (b) *Rambutan and Durian.*—Observations on flowering, fruit quality and genetic compatibility were hindered by the paucity of flowers this year and results were inconclusive.

253. The coccid *Asterolecanium* sp. was received from Perak for identification and control measures were recommended. Caterpillars of a Sphingid moth on durian were reported by the Agricultural Assistant, Ipoh. Attacked trees were completely defoliated. Handpicking of the caterpillars was done.

8.—SOIL INVESTIGATIONS

(i) *Dryland Soil Surveys.*

254. *Kelantan*.—Field work was concluded on the Kelantan Schematic Reconnaissance survey and the data obtained during 3-field seasons has been plotted. A schematic reconnaissance map on a scale of 1:500,000 has been drawn up from the results and this shows that much the greater part of the State is occupied by shallow, steeply sloping soils in mountainous and hilly country which is not suited to large scale agricultural development. The proportion of good soils on land of low elevation and slope, which still remains undeveloped is very much less than that in any other east coast State. All the information obtained during the course of field work was plotted on 1:25,000 or 1 inch to 1 mile topo maps and this information, which is available for ready reference in the Soils Division should prove invaluable for planning the future development of the State of Kelantan.

255. *Kedah*.—The schematic reconnaissance survey of the sedentary soils of Kedah was resumed in early April, 1959, and reconnaissance surveys were completed in north, south and central Kedah. After the initial broadscale work had been completed the efforts of the surveyors were concentrated on delineating the boundaries between the main soil associations throughout the State. Field work was completed by early September and during the last quarter the field data was plotted and a draft map drawn up. A bulletin on the "Sedentary Soils of Kedah" is in course of preparation, and Standard Soil Series descriptions have been completed for circulation within the Department.

256. A detailed reconnaissance soil survey of a 5,000-acre block in the Naka-Nami Road area of north Kedah was carried out and a soil survey report and map were prepared.

257. A soil suitability certificate covering the Sungei Tiang Land Development Scheme was issued in May and a soil survey of a proposed extension to this area was reported on in July.

258. *Perlis*.—A report on the reconnaissance soil survey of the Kaki Bukit-Padang Besar area was issued during January.

259. *Pahang*.—Field work on the Maran Road (Phase 1) 5,000-acre Development Area was finally completed at the end of the second quarter and virtually the entire area was found to be suitable for rubber cultivation although no areas of very rich soil were found. The soils of the area were found to vary considerably within narrow limits so that without detailed mapping, which is not practicable under jungle conditions, soil boundaries could not be accurately delineated.

260. A visit was paid to the proposed Kampong Jawa Drainage Area near Kuala Rompin on the east coast by soil

scientists from the Department of Agriculture and R.R.I., but the area was declared to be unsuitable for development by smallholders for dryland crops. Work is in progress on the survey of a proposed smallholder oil palm area on the Maran Road but indications so far are that the area is not too promising.

261. During July a brief air reconnaissance was made of the Temerloh-Jerantut-Maran "triangle" to study the topography and decide on possible rentis positions, should it be decided that in the near future development of a large block of land of this nature is justified by the demand for new agricultural land and soil survey found to be necessary.

262. *Negri Sembilan*.—Inspection of a proposed 3,000 acre development block at Ayer Hitam near Bahau, was carried out and a report issued. A soils clearance certificate was issued for the Sungei Raya (Stage II) drainage/development scheme early in 1959. This area was considered to be suitable for a development scheme involving cultivation of coconuts and coffee by smallholders.

263. *Malacca*.—Soil suitability certificates were issued for proposed development areas at Bukit Apit, Solok Menggong, Machap, Hutan Percha, and Phase II of the Kemendore Scheme. Reports were issued on proposed areas at Hutan Percha, Lipat Kajang, and on samples taken at Paya Kampong Lanchang.

264. *Johore*.—Soils clearance certificates were issued for proposed development schemes at Parit Haji Idris, Sg. Tiram, Tebrau and Kongkong. Visits were made to Paya Lebar and Ayer Hitam proposed development areas and to the proposed Sg. Juasseh rubber seed garden. The Paya Lebar area was found to be unsuitable for development by smallholders and it was suggested that it might be possible to find a better site than Sg. Juasseh for a rubber seed garden. Samples from a proposed development block on Paloh Road were examined and the area was found to be of marginal suitability for development and a visit by a soil surveyor will be necessary. A certificate of soil suitability was issued for the proposed smallholders' oil palm schemes at Kulai and it will be of great interest to see the degree of success achieved by this scheme.

265. A number of oil palm estates in south Johore were visited and some of the soil series identified during the course of independent soil surveys were examined and compared with existing series set up by departmental soil surveyors, and an attempt made to correlate the various series into a uniform classification. A number of soil monoliths and samples, mostly of soils derived from basic volcanic and intermediate volcanic rocks were taken for correlation purposes.

266. *Province Wellesley*.—Analysis of all the soil samples taken during the Juru-Jajawi soil survey has not yet been completed, shortage of Junior Staff in the laboratory having caused a serious hold-up in the through-put of samples.

267. *Perak*.—Certificates of soil suitability have been issued for Block New Planting Schemes at Seberang Manong, Kubang

Pekan, and Sg. Benderang. Soil samples from a proposed new planting scheme at Gunong Tunggai has been examined and drainage of the area prior to development recommended.

268. A report was issued on the proposed Sg. Pilus Land Development Scheme. The potentialities of the area for agricultural development were limited by the wide occurrence of steep land.

269. *Selangor*.—Visits were made to a number of oil palm estates in order to classify the alluvial soils on which the palms were growing and obtain some idea of which soil types were most suitable for oil palm cultivation and which soil factors were likely to limit yield.

(ii) *Schematic Mapping*.

270. The survey techniques to be used in tackling the more developed west coast States were tested during the year, and a small experimental survey was carried out in a part of the north Selangor region. This revealed that traverse lines about 3 miles apart and soil examinations at about $\frac{1}{4}$ mile intervals would be adequate for schematic-reconnaissance purposes. Existing roads and tracks will be the main traverse routes in developed and semi-developed areas, while foot paths and rentis lines would be used in the less developed regions. The steep mountainous areas will be avoided as their agricultural potential is considered to be very low.

(iii) *General*.

271. Correlation and classification work on Malayan soils was continued during the year, and the monolith collection, which forms a most useful reference for classifying soils from "*ad hoc*" areas, was added to, and now totals more than 80 separate profiles. Liaison was continued with private interests who are carrying out their own soil surveys on planted land and are using the same system of classification.

(iv) *Padi Soil Surveys*.

272. (a) *Potential Padi Areas*.—Soil samples from a proposed irrigation scheme at Ulu Beranang, Negri Sembilan, were examined and the area recommended as suitable for padi cultivation.

273. (b) *Existing Padi Areas, Kedah/Perlis*.—Field work on the above survey was continued during February and March. Very good progress was made and the soil survey of the Kedah/Perlis Coastal Plain is now virtually completed, apart from some 14,000 acres in the districts of Yen and Dulang where difficulty of access to tractors, and off-season cropping, retarded rate of progress. Some checking of soil boundaries still remains to be done and it is estimated that a further 3 weeks of field work will be required during the 1960 season. During the present field season the survey covered some 150,000 acres, some 400 miles of traverse lines being put in generally at a spacing of about $\frac{1}{4}$ mile and with inspection pits at intervals of 200 yards. Within the "gelam" areas such close coverage was not possible but traverses made through the "gelam" have established that the gelam forest does in fact occupy

an exceptionally uniform area of soil which has been classified as Kampong Telok series. This soil is characterised by a rather peaty black, friable topsoil, very strong, medium to coarse sub-angular blocky structure and a matrix colour which varies from light grey to brownish grey in the "acid phase". Iron oxide deposits along root channels and structure faces are heavy and the subsoil is generally highly acidic.

274. *Kelantan*.—Soil survey of the established padi areas of Kelantan was continued during May and June and good progress was made. Tractor-powered augers were utilised continuously for the first time on this survey and despite the rather broken nature of the landscape as compared to the Kedah padi-lands, the rate of progress was considerably increased and the soil could be more closely examined than was found possible when small diameter hand augers were employed. It was not found necessary to broaden the original classification of the soils. Next year's work will consist of checking doubtful boundaries and completing survey of the small remaining unsurveyed area on the west bank of the Kelantan River. This should require only some two weeks of field work after which it is hoped that the survey teams will move down into the Trengganu padi areas and carry out a complete survey there.

275. Soil samples were taken from six sites representative of the six main padi soil groups identified during the Kelantan padi soil survey, and pot experiments have been carried out in Kuala Lumpur to study their fertiliser requirements.

(v) *Investigations.*

276. (a) *Soil Sampling and Analysis*.—A certain amount of re-organisation has been carried out in the laboratory, particularly with respect to storage of samples and a revised system of registration has been introduced. Shortage of Junior Staff has seriously reduced potential output of work from the laboratory and a number of lines of investigation have had to be postponed until the staffing situation improves.

277. In the course of crop-cutting tests at randomised points in the Kedah Plain soil samples were taken by the statistician and at the same time other information as to padi variety, etc., was collected. These samples will be analysed and an attempt made to link up yield with soil nutrient content.

278. *Cation Exchange Capacity*.—Work has been continued on soil samples taken during the Kedah/Perlis soil survey. With improved technique, up to 175 analyses per quarter can be carried out. A number of analyses have been carried out on samples taken from the concrete tanks in which experiments on leaching of sulphurous soils are being conducted. Difficulties were encountered however on account of the high acidity of the soil, heavy precipitates being obtained in the leachates.

279. *Sulphate Determinations*.—The present method of sulphate determination involves a gravimetric determination which, although accurate, is very slow. Two new methods have been tried out, in an effort to speed up the determination, both involving

the precipitation of sulphate with barium chloride solution, followed by back titration of the excess barium with versenate. In one method a blank titration is done to allow for the cations present in the soil extract, while in the other method the cations are removed on an ion exchange resin prior to adding the barium chloride. The former has given results comparable to the gravimetric method, while the latter although a little faster is less accurate.

280. *Checking of Analysis Methods.*—Samples of soil and plant materials have been forwarded to various laboratories in Malaya to be analysed by the methods currently employed there. Results of analysis have been received from a number of these laboratories and so far agreement with our own analyses has been reasonably good in the case of the soils and exceptionally good in the case of the plant material.

(b) Plant Nutrition and Soil Fertility.

281. *Tank Experiments.*—Padi grown on the “Bris” soil from Kelantan was harvested and the yield showed a slight increase due to phosphate, a marked increase due to nitrogen and was doubled by the addition of both nitrogen and phosphate, slight increases in yield seem to have been made when other elements were added in combination with nitrogen and phosphate fertilisers. Analysis of the padi plants show that for satisfactory growth of padi on the “Bris” nitrogen and phosphate fertilisers are absolutely essential. Iron and potash are low in the “Bris” soil although they seem to have had little influence on the yield of padi. Deficiency symptoms and reduction of yield due to lack of these elements may result if padi is grown continuously without their application.

282. As an off-season crop on the “Bris” groundnuts were planted. Satisfactory growth was made in all treatments which received phosphatic fertiliser. Where plants did not receive phosphate fertiliser growth was poor and the plants were stunted. The best yield of groundnuts was given in the tanks which had peat in addition to major and trace elements. It is possible that the capacity of peat to retain moisture might have been responsible for the higher yields. The yield of groundnut kernels per acre in the best treatment amounted to 1,880 lbs. which is as good as those obtained from fertile soils.

283. Soya beans were planted in the bris soil after the groundnuts were harvested. Good growth was made in all tanks which were fertilised with phosphate. The soya beans were dug in as green manure for padi. Padi plants which received this green manure have more tillers and look healthier than those without green manure.

284. A trial with different methods of adding nitrogen was conducted on a poor soil from Batu Kikir, Negri Sembilan. It was found that addition of nitrogen in accordance with recommended practice in Negri Sembilan produced no increase in yields of padi over the control. The addition of nitrogen (total 100 lbs. per acre as N) weekly and fortnightly increased yields of padi over the

control to approximately the same extent. The highest yields recorded in this experiment was 790 gms. of dried grain per tank or approximately 1,200 gantangs per acre and was obtained with fortnightly addition of nitrogen.

285. In the same soil, soya bean and Okra (*Hibiscus esculantus*) were planted as off-season crops. The Okra plants which received complete fertiliser made good growth. There was no appreciable difference between the fertilised and unfertilised soya beans due probably to the fact that the previous padi crops had received heavy dressings of phosphate. Padi has been planted again in this soil in order to find the effect of off-season cropping on the yields of padi. At the present stage very little difference is shown as a result of the various off-season treatments. Appreciable difference is being shown between fertilised and unfertilised padi.

286. In the tank experiments with the "gelam" soil from Tanjong Minyak, Malacca, an attempt was made to grow Okra as an off-season crop on the subsoil. It was found that Okra seeds did not germinate and transplanted seedlings died in the two tanks in which the soil was kept under water during the padi season although the tanks received complete fertiliser and the pH of the soil was between 5.3 and 4.0. Okra seeds germinated and made very poor growth in the subsoil which was drained and fertilised but had a pH of only 3.6. Better growth was made in the drained, limed and fertilised subsoil. Okra seedlings planted on the topsoil (Gelam) and given complete fertiliser grew satisfactorily.

287. Padi seedlings were transplanted in the tanks containing "gelam" subsoil and topsoil. The seedlings which were transplanted into the subsoil which a few months before was kept waterlogged had their tips scorched and in a few days the plants dried up. In the tanks containing topsoil which was treated with lime only, growth was poor. In the tanks where off-season crop Okra was grown and which received complete fertiliser growth of padi was good. The best growth was shown by plants which had received green manure in addition to complete fertiliser. These trials seem to indicate that for successful development of the "gelam" soil the following procedures are necessary:

- (1) Cultivation and draining of the soils for a considerable period in order to oxidise the sulphides to sulphates, which can then be leached out.
- (2) Liming to reduce excess acidity.
- (3) Addition of fertilisers which do not contain any sulphate.

288. *Pot Experiments with Padi.*—Observations were made on growing padi seedlings in pots and in a nursery box. It was found that with an average padi soil about $1\frac{1}{2}$ lbs. of a complete fertiliser (Di-ammonium phosphate, potassium phosphate) per 100 sq. ft. with seeding density of 0.7 lb. of padi per 100 sq. ft. produced large and healthy seedlings with a mass of roots. It was also found that in a very poor soil as much as 3 lbs. of chisso-phoska per 100 sq. ft. was required to produce satisfactory seedlings at a seeding rate of about 1 lb. padi per 100 sq. ft.

289. Padi plants were grown in pots containing a soil from Seriting Ulu, Negri Sembilan, as part of an investigation to devise a suitable method of determining fertiliser requirements of padi soils. Analysis of the plants showed that phosphate was very deficient, nitrogen was low and the addition of iron and manganese may be necessary for the good growth of padi on this soil. The results seem to indicate that the method could be used establishing a scale of soil fertility for the various padi series identified in the course of soil survey.

290. Pot experiments with padi as the test plant were conducted on a soil from Byan Pyas, near Telok Anson, and on a soil from the Soil/Water Research Station at Tanjong Karang. Analysis has been done on the plants harvested at the flowering stage. The results show that the virgin Byan Pyas soil is fertile and padi plants grown on this soil show little or no response to fertiliser. On the Tanjong Karang soil padi plants responded to nitrogen. Indications are that the soil is also low in calcium.

291. Pot experiments are being conducted on six Kelantan padi soils. Padi plants were transplanted into pots in the 1st week of November. In all the soils the plants have responded to the addition of super-phosphate to a marked degree. Addition of initial doses of urea before transplanting combined with super-phosphate has made for better growth in most of the soils. One of the soils was taken from a very poor area in which padi is grown only once in three years. In this soil plants respond to the application of super-phosphate, urea and other fertilisers. Analysis of the plants at flowering and final harvest will indicate what elements are deficient in these soils and give an idea of what fertiliser and how much is needed for good growth of padi.

B.—AGRONOMIC AND LIVESTOCK INVESTIGATIONS

1.—CROPS

(A).—Padi

(i) Wet Padi

(a) *Mechanisation.*

IMPLEMENTS

292. Trials designed with a view to developing a padi thresher suitable for use by smallholders in Malaya were completed during the year. An engineer from the National Institute of Agricultural Engineering in the United Kingdom spent several months in Malaya testing and developing a prototype model. This model—which is aptly named the “Midget Thresher”—was first developed in 1957. The completion of developmental work early in 1959 resulted in the first commercial models becoming available for the 1958/59 harvest.

293. Trials carried out during the 1958/59 harvesting period indicated that the machine in its final form is suitable for use by smallholders. It may be used in the following ways:

- (i) Threshing from large prepared heaps; a system suitable where it is customary to thresh by allowing animals

to tread out the grain. Grain output was very satisfactory using this technique but labour requirements were high.

- (ii) As a substitute for a "Tong", the machine being moved around the field following the reapers. Five operators are required but there were no labour requirements for heaping as in method (1).
- (iii) Head stripping. The labour requirements are low but the quality of threshing is poor. The straw is left in an undamaged condition and this feature may be of value should straw be used for rope making, etc.

294. Data obtained on throughput shows wide variations; however this is due mainly to difference in crop yield between sites and the variable quality of labour. It was found from trials carried out that there are no advantages to be obtained from peg drums as compared with rasp bar drums. Running at drum speeds of between 4,500 and 5,000 ft./minute with minimum outlet concave clearances of 3/16 in. the amount of broken grain in the sample was negligible. At these settings no relationships were found to exist between the grain moisture content, rate of throughput and percentage of broken grain in the sample. Damp straw however tended to slow down the rate of working as a result of the tendency to wrap around the drum.

295. Testing of small commercial tractors for their suitability for mechanising smallholder padi production in Malaya has met with a greater degree of success than was anticipated. The Merry Tiller, a two wheeled horticultural tractor developed in Japan and tested in 1958 showed only limited promise under Malayan conditions despite modification. A substantial number of machines of Japanese and British manufacturers were tried in the field but two only proved to be promising. These are the Kubota KF manufactured in Japan and the Landmaster 150 developed by a Ceylonese engineer and manufactured in the United Kingdom.

296. The Kubota KF has a 6 H.P. diesel engine and is fitted with a rotavator and various attachments. It is a powerful, easily managed machine which is capable of producing a well puddled wet padi field with three cultivations at a total cost of approximately \$12 per acre or about \$24 when allowing for depreciation. It is a most promising machine, the most important drawback to its use being its relatively high market price. The Landmaster 150 is a smaller 4½ H.P. machine. It is essentially simple in design and in consequence is available at considerably lower cost. Tests on this machine are as yet incomplete but it has considerable potential for smallholder cultivation of wet padi in Malaya.

297. The improved animal drawn plough developed for the cultivation of wet rice fields has been manufactured in quantity for trial by smallholders throughout Malaya. The general consensus of opinion is that they are an improvement on traditional models, however in a few areas the new plough is not regarded favourably. In these areas the specific problems of buffalo ploughing are to be more closely examined next season.

PADI MECHANISATION SCHEME

298. The padi mechanisation scheme at Parit was initiated in 1954 with a view to clarifying problems associated with the complete mechanisation of padi growing and to determine the optimum size of a mechanised family unit farm. A great deal of valuable information on problems of land clearing was obtained in the early years but it was found subsequently that uneven settlement of soil severely hampered attempts to grow padi. It was decided in 1958 to contour level the whole station and this provided satisfactory internal control of irrigation water throughout the scheme and has resulted in considerable increases in crop yield. The variety "Engkatek" which is particularly suitable for mechanised cultivation was grown again this year and the average yield was 317 gantangs per acre, an increase over the 1958 harvest of 135 gantangs per acre.

299. The padi crop suffered severely from damage by stem borer, *Sesamia inferens* despite prophylactic measures taken following the previous harvest. In 1958 stubble had been burned and the land ploughed, however sources of infection remained in adjacent fields managed by smallholders. Random sample cuts in 1958 suggested that about 30 per cent of the crop had been lost due to stem borer damage. In order to ascertain the relative economic merits of recommended measures for chemical control of stem borer attack, two areas, each of approximately 35 acres, were sprayed either with B.H.C. or D.D.T. in November, 3 to 4 weeks before flowering. A smaller untreated control area was also allowed for. At the end of the year the percentage of bored tillers was greatest in the untreated control plot and least in the area treated with B.H.C. The relative economic merits of the two control measures are being examined and data should become available early next year.

300. Incidence of weed growth has been reduced to some extent as a result of adequate control of water being obtained. The incidence of dicotyledonous weeds was very low but grass weed and particularly *Echinochloa colona* and *Leptochloa chinensis* remain a serious problem. These gramminaceous weeds are a carry over from the off-season cropping programme. The seed germinates a little earlier than the padi and the grasses grow ahead of this crop. Investigations conducted to ascertain the relative costs of different techniques of eradicating the weed showed that sodium chlorate applied at 25 lb./acre in 100 gallons of water in the off-season before the majority of the grass weed seeds, followed by a minimum of hand weeding in season, was a considerably cheaper control measure than use of either the sodium salt of dichloropropionic acid or hand weeding with traditional tools. An important outcome of these simple investigations has been the testing of a series of hand tools for weeding flooded fields. One of the hoes which was tested is a development of a Dutch Hoe. It is provided with a wavy cutting edge on both the front and rear side of the blade. This tool is manufactured by Wolf Tools and is catalogued as Dutch Weeder RF 15. It is particularly efficient in flooded fields and has reduced the time spent in hand

weeding by 25 per cent while at the same time rendering the work involved much less arduous.

301. In Japan hand-operated rotary cultivators are widely used for cultivation and aeration of soil and weeding. To achieve the benefits claimed for aerating soil efficient control of water is necessary and the technique is under examination at the padi mechanisation project and in irrigated areas in Province Wellesley. It is clear that for efficient operation in aerating soil they must be used immediately following drainage. They operate as weeders in flooded fields provided the depth of water does not exceed 3 in. but their efficiency in this respect is better with transplanted padi than with the drilled padi in the mechanisation scheme as two directional use is then feasible.

302. In the off-season the areas which were not being contour levelled were sown with off-season crops. The object is to ascertain in the first instance which crops are most suited to mechanised cultivation and then at a later date to develop systems of rotation bearing in mind the economic potential of the crops concerned. Soya bean again proved to be the most easily mechanised crop. Maize was reasonably satisfactory but suffered from damage caused by monkeys. Chillies were profitable but mechanised cultivation proved to be difficult.

(b) Agronomy.

303. The padi agronomic research programme has been substantially developed in the 1959/60 season. Important changes in investigational policy have been made in view of findings from extension trials conducted on smallholders land in previous years. These trials have been summarised during the year and the findings reported in an information paper. The paper was also presented at the 7th Meeting of the Working Party on Rice, Soils, Water and Fertiliser Practices of the International Rice Commission at the request of the Regional Soil Fertility Specialist of the F.A.O. who had given help in improving the techniques used in extension trials. It became apparent as a result of these trials that improvement in husbandry techniques was a necessary essential for adequate response to fertiliser application and investigations in the 1959-60 season have been planned with this in mind. It has been feasible to knit the programme of work conducted by the Japanese Colombo Plan Team into the overall programme and improvements in the staffing situation has permitted work to be resumed in Kelantan.

NURSERY INVESTIGATIONS

304. The Colombo Plan Team working at Bukit Merah in Province Wellesley have studied the effect of sowing density and rate of application of nitrogen in the nursery. They have confirmed existing evidence that in wet nurseries sowing density is a most important factor influencing seedling growth and rooting ability. In dry nurseries this aspect appears to be of less importance. Nitrogen applied to seedlings in the nursery improves the appearance of the plants but it has been shown that when applied in excess especially as a top dressing it reduces the ability of the

transplanted seedling to produce new roots and in this way has a detrimental effect. It is confirmed that phosphate is of particular importance as nutrient for use in nurseries and that there is a reciprocal relationship between nitrogen and phosphate. There is no evidence of a need for potash. These results support the use of ammonium phosphate compounds as nursery manures.

305. The Colombo Plan Team developed and perfected a technique for producing padi seedlings from dry, irrigated nurseries. Seedlings produced from these nurseries were shown to be tolerant of excessive dressings of nitrogen and displayed greater rooting ability when transplanted than seedlings from wet nurseries. These benefits are reflected in early tiller counts but differences disappeared when expressed in terms of yield.

306. It has been shown in formal trials conducted in Kedah that both nitrogenous and phosphatic manures are required in wet nurseries when recommended husbandry practices are followed. In the event of seedlings being retained in the nursery beyond the optimum time of transplanting it has been clearly demonstrated that nursery manuring cannot be expected to correct the inevitable loss of yield consequent upon use of such seedlings.

307. In the 1959/60 season a series of nursery manurial investigations were laid down. These include a formal NPK factorial trial on wet nurseries and pilot trials designed to clarify the optimum size of nursery and rate of application of ammonium phosphate fertiliser. The value of farmyard manure and limestone both with and without ammonium phosphate manures has also been studied both on wet and dry nurseries.

308. It has been shown quite clearly that N and P_2O_5 in combination are essential for the production of healthy padi seedlings. Both nitrogen and phosphate alone fail to produce satisfactory growth and there is no evidence that potash is required. Muriate of potash has been shown to be an undesirable nutrient carrier for use in nurseries on light soils and there is slight evidence to indicate that the sulphate as well as the chloride radicle is best excluded from nutrient carriers used on the nursery. It would appear from preliminary investigations that farm yard manure is likely to be a valuable asset in both wet and dry nurseries. In dry nurseries the optimum rate of application seems to be about 1 to $1\frac{1}{2}$ lb. per sq. ft.; in wet nurseries $\frac{1}{4}$ to $\frac{1}{2}$ lb. per sq. ft. is sufficient.

309. Current recommendations for the manuring of wet nurseries is application of mono ammonium phosphate 11:48 applied at the rate of 2 lbs. per gantang of seed broadcast over an area of 500 sq. ft. Seedlings grown in nurseries treated in this way sometimes exhibit symptoms indicative of nitrogen deficiency prior to transplanting. This does not occur when farm yard manure is used but it would seem that it can also be avoided by the use of di-ammonium phosphate 21:53 in place of the mono ammonium compound.

310. Size of nursery and rate of application of the standard recommended fertiliser dressings has been further considered.

Investigations suggest that there may be justification for increasing nursery size and rate of application of fertiliser, however the full expression of results must await harvest in 1960. The manuring of dry nurseries with double superphosphate at 10 lbs. per gantang of seed per 500 sq. ft. seems to be markedly beneficial. Limestone appears to have had little or no effect on the growth of seedlings in either dry or wet nurseries.

FIELD MANURIAL TRIALS

311. The field manurial investigation programme has been concerned both with fundamental aspects of nutrient requirements in the field, the comparative values of different nutrient carriers and economic features of manuring.

312. The Colombo Plan Team working in Province Wellesley have concluded as a result of a series of investigations that clarification of techniques of applying manures is of the greater *immediate* importance than determination of the actual nutrient requirements of the crop in any particular area. This is in direct agreement with our own findings. At Bukit Merah the Colombo Plan Team have shown that responses to application of nitrogen, potash and certain basic materials are noticeable in terms of increased yield whereas this was not the case with phosphate. This may be due to accumulation of phosphate as a result of substantial dressings in earlier years. The Colombo Plan Team have shown in a set of trials that furnace slag from Japan containing substantial quantities of CaO and Si O₂, a certain amount of MgO and sometimes Fe₂O₃; and Mn O has not influenced yield when applied as a pre-planting dressing. Similarly no significant differences were obtained as a result of using different types of phosphatic manures or nitrogenous manures. In contrast to these negative results simple investigations into techniques of applying fertiliser support the viewpoint that placement of fertiliser may be of importance and this aspect is receiving attention in the 1959/60 programme.

313. In Kedah in the 1958-59 season NPK 3³ factorial trials at Telok Chengai and Hutan Kampong padi stations fail to show significant responses as a result of applying nitrogen, phosphate or potash. Yields in the control plots are in the region of 4,000 lbs. per acre and it seems that fertiliser responses are masked as a result of high soil fertility. Visual evidence from these and other trials suggests that the technique of applying nitrogen requires further examination in relation to uptake of this nutrient by the plant. This is the subject of investigation in the 1959/60 season. There is reasonably clear indication from pilot trials carried out on the granitic wash soils of Kelantan that ammonium phosphate 16:20 is suitable as a base fertiliser for padi production. The economic aspects of the use of this compound fertiliser is the subject of investigation in the 1959-60 season.

314. Results from an experiment in Kedah designed to study the long term economic and fertility aspects of disposal of padi straw continue to support the view that removal of straw from the land has no effect on crop yields when compared with burning

the straw *in situ* or spreading it over the field. The trial is now in tenth year and serves to support the view that in the conditions prevailing in the district straw can be sold or otherwise disposed of for a decade without the likelihood of any ill effect on soil fertility becoming apparent.

315. In the 1959/60 season the rate and timing of application of nitrogen has been the subject of particular attention and the suitability of different nitrogen carriers is being studied. Phosphate carriers are again the subject of investigation and trials in hand are designed to ascertain the value of fused magnesium phosphate in different padi growing areas. Placement of N, P and K fertilisers is being studied and the value of fertiliser carriers containing a high content of silica is under consideration. The economic value of certain ammonium phosphate compounds for field manuring is being further examined and the need for limestone in relation to response to fertiliser application is being ascertained.

316. Positive results from these investigations will not be available until 1960, however it would seem from limited evidence at the end of the year that it may be advantageous in most areas to apply a proportion of the total nitrogen requirement as a base dressing.

FIELD HUSBANDRY INVESTIGATIONS

317. It was reported in 1958 that within specified limits, the closer padi plants were spaced the greater the yield obtained although the total number of tillers per hill were reduced. The Colombo Plan Team have confirmed this finding during the current year and have further examined the subject as it is considered to be of fundamental importance in relation to increasing the yield of padi. They have shown that in the case of rectangular planting the within row spacing should not be reduced to less than 6 ins. The finding is supported by evidence from the results of trials conducted in Kelantan and Trengganu. The Colombo Plan officers have also demonstrated that adequate and thorough cultivation of the field prior to planting results in improved tillering and higher yield. The benefit so obtained is further increased by improved post transplanting management and it has been shown in relation to this that thorough drying and oxidation of the soil in the field prior to flooding is beneficial. This technique has a direct application in irrigated double cropped areas. Investigations are currently in progress to ascertain whether the transplanting of padi on ridges, the tops of which are above water level can be expected to influence yield.

318. Investigation of the use of herbicides for weed control on wet padi has been carried out by a Colombo Plan agronomist. It has been shown that the sodium salt of Pentachlorophenol (P.C.P.) was suitable for use as a preplanting soil dressing preventing weed establishment for a period of about three weeks. It should be used only a few days before transplanting and to avoid serious damage to the padi crop the optimum rate of application appears to lie between 5 lbs. and 10 lbs. of the herbicide per acre. It was concluded that effective weed control throughout the growing season could be achieved with the short

term variety, Pebifun, by the application of the sodium salt of P.C.P. at not more than 10 lbs. per acre as a preplanting soil dressing followed by Aquatic 2:4D (Ishiwara) 3 to 5 weeks later at 0.75 lbs. acid equivalent per acre. There is no evidence however to indicate that the use of herbicides in the manner described is an economic proposition.

319. The use of green manures on the Kedah plain and in some other non-irrigated single crop areas has always been a problem as conditions following harvest are usually too dry for crops either to establish, or to grow if established before the padi is harvested. Investigations in the current year have shown that *Sesbania aculeata* can be grown successfully in Kedah if sown in March and ploughed in May. *Crotalaria* spp. are also promising and pilot trials conducted on sandy soils in Kelantan indicate that growth of padi benefits appreciably from the use of green manures.

320. An important husbandry investigation has been laid down in the current year with a view to ascertaining the effect on growth and yield of padi of all combinations of high and low levels of management both in the nursery and in the field. It is intended that this investigation will clarify the relative economic importance of various husbandry recommendations. Another husbandry investigation which has been put down this year for the first time is a trial designed to clarify the relative economic aspects of utilising a shorter term variety transplanted at an appropriate age instead of overage seedlings of longer term varieties. The latter are used when shortage of water delays planting but it has been reported previously that the yield potential of overage seedlings is seriously restricted.

321. Other new investigations consist of an examination of the economic value of cultivating padi fields mechanically, the development of spacing trials and an examination of the effect of drying padi fields periodically. At Bumbong Lima Padi Test Station in Province Wellesley a simple, but very long-term investigation was initiated during the year. This investigation is designed to outline the relative economic and cultural aspects of double cropping with padi, growing padi in the main season and either other commercial crops in the off-season or a green manure or alternatively leaving the land fallow.

322. During the 1959-60 padi season a technique was developed for conducting a sample survey in padi areas in Kedah incorporating crop cutting tests for yield estimation and the collection of information on field conditions and farmers' practices. The technique has proved practicable and it is hoped the information collected will prove of value in planning future agronomic research. A paper was produced during the current year in which the more important features of padi husbandry in Malaya are summarised. This paper is now a standard text for extension workers.

(ii) Dry Padi

323. A limited investigational programme was initiated in Kelantan in the current season. Investigation has been restricted

to pilot trials designed to indicate the value of pre and post emergence herbicides for weed control in dry padi. The following tentative conclusions were reached as a result of investigations:

- (a) P.C.P. (Sodium salt of Pentachlorophenol): Optimum rate of application appears to be in the region of 10 to 15 lbs. per acre. This proved to be the most efficient herbicide tested.
- (b) C.M.U. [U-(p-chlorophenyl)-N'N'-dimethylurea]: Harmful to padi at the rates used. Further investigation at rates of $\frac{1}{4}$ to $\frac{1}{2}$ lb. per acre is probably justified.
- (c) 2,4-DES [Sodium 2-(2,4-dichlorophenoxy)ethyl sulphate]: Harmful to the crop when applied as either a pre emergence or early post emergence spray at 3 lbs. per acre.
- (d) The following herbicides—
 - (i) C.I.P.C. (Isopropyl-m-chlorocarbanilate)
 - (ii) C.D.A.A. (NN-diallyl-a-chloroacetamide)
 - (iii) M.C.P.A. (4-chloro-2-methyl-phenoxyacetic acid)
 - (iv) 2,4-DES [Sodium 2-(2,4-dichlorophenoxy)ethyl sulphate]were found to be ineffective against weed species found under test conditions.

(B).—Coconuts

324. Development of the coconut station at Telok Bharu in Lower Perak has continued. A further 35 acres of the station has been cleared of secondary jungle and belukar during the year and development of the station with the exception of 40 acres leased under T.O.L. will be completed in 1960. A substantial proportion of the area originally scheduled for use in 1958 was planted for the Botany Division using seedlings from selected mother palms. The block cleared in 1958 for use in the current year was sown with cover crops and 420 seedlings from selected mother palms were planted in November. In the course of providing replacements and new planting 1,327 seedling palms were planted during the year.

325. Investigations on an estate in the same district and on similar coastal clay soils continues to emphasise the importance of nitrogen, phosphate and magnesium limestone on the growth of young palms. Palms receiving manure in these investigations are being brought into production at an early age and yields in the first year of bearing are most encouraging. All palms at the Federal Experiment Station, Telok Bharu now receive regular dressings of nitrogenous and phosphatic fertiliser and annual dressings of magnesium limestone. A number of Dwarf palms planted in 1956 and a very few semi talls planted in 1956 and 1957 flowered during the year. The first ripe nuts from a semi tall palm were harvested toward the end of the year.

326. Rhinoceros beetle (*Oryctes rhinoceros*) remained a major problem in the establishment of young palms. Dwarf palms appear to suffer more severely than talls. No method of control

has been found which is more effective than destruction of breeding grounds, however it has been noticed that the smell of several insecticides appears to act as a repellent. An area of land has been planted with estate selected palms with a view to studying the morphological development of roots in a clay soil. The root development of individual palms will be studied over a period of several years with a view to clarifying penetration and spread and the probable effect of these features on techniques of applying manure.

327. The coconut manurial trial which is being carried out on small-holders' land on bris soil in coastal Trengganu has been the subject of considerable enquiry during the past year. It has been concluded that the design of the trial does not make adequate allowance for spread of the root systems of palms and that in consequence differences between treatments are being confused by the poaching effect of palms in adjacent treatments. There is still a marked response to application of 7 lbs. per palm of a complete fertiliser. No further noticeable improvement is recorded however as a result of doubling the rate of fertiliser application. It would seem that the response to even the lower rate of fertiliser application although noticeable is insufficient to warrant expenditure on fertilising the palms but this supposition must be considered with reserve as there is no true yardstick from which to measure the control plots in the trial being of little value due to the probable trespass of their root systems into manured plots. The economic aspects of attempting to rehabilitate old coconut palms on bris soil have not been answered by this trial, however it appears that regularly planted ex estate palms on bris soil may become available for use in the near future and consideration is being given to putting down investigations in this area to study the problem more thoroughly.

328. Manurial and variety trials on poor inland soil have continued. No clear cut differences have been obtained to date and this despite the fact that in the manurial trial—which is of factorial design—treatments have been applied for three years. A simple manurial investigation has been put down on a coconut estate in the Dindings. This investigation is designed to ascertain the qualitative manurial requirements of young palms on a medium textured soil and to explore the economic aspects of manuring young palms in the area.

(C).—*Fruit*

329. The fruit investigation programme has been hampered by a shortage of experienced professional officers. It has again not been feasible to make an officer available for more than a part time supervision and planning of investigations.

(i) *Banana*

330. A factorial manurial trial with the Canary banana at the Federal Experiment Station, Cameron Highlands, is nearing completion. Results have yet to be subjected to statistical analysis but the data obtained suggests that it is unlikely that this variety will be able to complete commercially with higher yielding varieties

grown in the lowlands. A collection of local varieties has been maintained at the Federal Experiment Station, Serdang.

(ii) Rambutan

331. An eleven years old variety trial at the Federal Experiment Station, Serdang, has been given a great deal of attention during the current year. Eleven varieties have been described in detail in a published article and the five most promising varieties to date namely R. 7 (Kepala Besar); R. 12 (Kelip²); R. 4 (Ya Tow); R. 3 (Peng Th'ng Bee) and R. 86 (Singapura) are tentatively recommended for commercial use.

332. Further variety and manurial trials which it was intended should be put down at the Federal Experiment Station, Serdang, in the current year have been postponed as it was not possible to give preparation for the trials sufficient attention. It is hoped that the staffing situation will improve sufficiently to justify putting the trials down in 1960.

333. A simple investigation has been put down at the Federal Experiment Station, Jalan Kebun, to observe the effect on growth and yield of rambutan grown on deep peat soil of different spacing, the use of filler trees and the effect of providing approach grafted support trunks. The last named treatment is to be completed in 1960 and the response will be watched with interest. Another informal investigation on the same soil type is designed to clarify the comparative growth rates and yield of 9 rambutan clones planted at two different spacings. Superimposed on this but without regard to the location of clonal material is a pilot investigation which is intended to provide some information on the qualitative requirements of some of the major nutrients, N, P, K, Ca and Mg.

334. It has been shown that on deep peat it is inadvisable to adopt an open centre pruning technique as rapid growth of the tree results in a weak framework and a weeping habit of growth which cannot be corrected by a system of replacement pruning. A natural head appears to be desirable with pruning designed to encourage a central trunk. It has been shown at the Federal Experiment Station, Kuala Lumpur, that top working old trees for budwood production is feasible. The technique in its simplest form involves cutting back the tree to leave only the stump of the main branches. These are then allowed to develop shoots and on each main branch the strongest growing pair of shoots situated one diametrically opposite the other and near the cut surface are retained. When about $\frac{3}{4}$ in. in diameter the shoots are budgrafted near their point of origin using budwood of the desired clone. The regenerated shoots are tipped but retained as lungs until no longer required.

(iii) Durian

335. The durian variety trial at the Federal Experiment Station, Serdang, produced on fruit during 1959. This is believed to be a seasonal effect as the durian harvest in the district was very poor. A number of rogues in this trial have been located

and the information recorded. Durian has been planted in observation blocks on deep peat soil at the Federal Experiment Station, Jalan Kebun.

(iv) Citrus

336. A formal grapefruit variety trial at the Federal Experiment Station, Gajah Mati in Kedah is now in its third year. Seven selected varieties on seedling pomelo rootstocks are being tested but losses due to drought in the early months of the year have caused a certain amount of anxiety. Drought has also been the cause of severe losses in a citrus rootstock observation on the same station. In this observation five rootstocks namely, pomelo, grapefruit, lime, *Citrus macroptera* and *Citrus Swinglei* are bud-grafted with selected varieties of five different scion species. The latter are local Mandarin orange, sweet orange, pomelo, grapefruit and the local lime. Mortality has been very heavy and it is probable in consequence that the investigation will have to be abandoned. Examination of the pattern of mortality serves to suggest that:

- (a) That Grapefruit and pomelo on the various rootstocks are more suited to conditions at Gajah Mati than either Mandarin orange or lime.
- (b) Both grapefruit and lime appear to be unpromising as rootstocks at Gajah Mati.

337. A formal rootstock trial is to be put down on coastal clay soil at the Federal Experiment Station, Telok Bharu, in 1960. Seedlings of rough lemon, sweet orange and different strains of *Citrus aurantium* are being produced at the Federal Experiment Station, Serdang. There are in addition a number of locally grown species such as pomelo, mandarin orange, Limau Chembol and possibly one of the more promising varieties from a collection of species made by the Botany Division. These rootstocks are to be budgrafted early in 1960 with selected varieties of grapefruit, and local Mandarin orange. A feature worth noting is that *Poncirus trifoliata* which is reported to be of value as a rootstock in both Indonesia and Thailand has failed to grow well at Serdang and has been deleted as a rootstock for use in this trial.

338. Seed gardens of the more important imported species/strains of citrus which may prove to be suitable for use as rootstocks have been planted each in reasonable isolation at the Federal Experiment Station, Serdang. The species planted are *C. sinensis* (sweet orange), *C. lemon* (rough lemon) and *C. aurantium* (sour orange). In addition to these, seed gardens of three potential rootstock species of local origin have been planted, i.e. *C. maxima* (pomelo), *C. suhuiensis* (Mandarin orange) and Limau Chembol.

339. A number of different types of citrus have been planted on deep peat soil at the Federal Experiment Station, Jalan Kebun. The performance of various types of citrus on this soil type is being studied.

(v) Pineapple

340. Responsibility for agronomic research on pineapple was taken over early in the year by the Malayan Pineapple

Industry Board. A Director of Agronomic Research has been appointed by the board and the Federal Experiment Station at Alor Bukit in Johore has become the centre for agronomic investigational work. Field investigations remaining under the control of the department have been terminated and attention has been devoted solely to the establishment of a varietal collection at the Federal Experiment Station, Jalan Kebun.

(vi) Cashew Nut

341. A variety trial and manurial observation conducted at the Agricultural Station at Kampong Raja in Trengganu were concluded during the year. A simple but reasonably comprehensive manurial investigation designed to clarify the qualitative major nutrient requirements of the crop was put down at the same station. The variety Besut—which so far appears to be the most promising—has been used in the investigation. This variety was originally obtained from Travancore in South India.

(vii) Miscellaneous

342. The possibility of growing the more important tree fruit crops on deep peat soil is the subject of investigation at the Federal Experiment Station, Jalan Kebun. Rambutan is particularly promising but a number of other species warrant further investigation. A number of additional species including durian have been established during the year.

343. Grape vines imported as rooted cuttings from Vietnam have been planted at the Federal Experiment Stations, Serdang and Kuala Lumpur in Selangor and at high elevation at Cameron Highlands in Pahang. Leaf eating pests appear to be a problem in the lowlands, however results were reasonably encouraging at the end of the year. At the Federal Experiment Station, Cameron Highlands, the health and appearance of the grapes was good.

(D).—Tea

344. Progress has been made with the establishment of blocks of clonal tea at both the Federal Experiment Stations, Serdang and Cameron Highlands. Blocks of twelve of the earlier planted clones at Serdang have been in plucking for some time and calculated mean yields of between 2,000 and 3,000 lbs. of made tea per acre per annum have been obtained—a promising initial response to this long term programme. The smaller clonal collection at the Federal Experiment Station, Cameron Highlands, is being expanded rapidly and the earlier planted clones have been pruned and plucking will commence during 1960.

345. An N.P.K.²³ factorial trial which is in hand at the Federal Experiment Station, Cameron Highlands, completed its second cycle and has been pruned. Yield data for the whole cycle has yet to be statistically examined however it appears that in contrast to the first cycle there is very little response to application of N & P when these nutrients are applied alone. When applied in conjunction one with the other however there is a marked increase in yield as was the case during the first cycle. An

interesting feature of the data is the apparent slight response to application of potash. This will be a feature of considerable interest in the third cycle. The extent and nature of the responses are as follows:

Calculated Adjusted Mean Yields of Made Tea

(in lb. per acre for the entire 2nd cycle)

	O	N	P	NP	Mean
O ...	2088	...	2309	...	2288
K ...	2014	...	2322	...	2447
Mean ...	2051	...	2316	...	—

346. A trial at the Federal Experiment Station, Cameron Highlands, designed to test the effect on yield of plucked leaf of several levels of nitrogenous manuring completed its second cycle and was pruned in August. In this trial nitrogen is applied at the rate of 0, 40 lbs., 80 lbs. and 120 lbs. per acre. All treatments receive a base dressing of 30 lbs. per acre each of P_2O_5 and K_2O . An unchecked summary of yield data for the complete cycle is as follows:

Calculated Mean Yields of Made Tea

(in lb. per acre for the entire second 3 year cycle)

Treatment	Yield/Acre	Increase Over Control
N_0 N nitrogenous fertiliser ...	2358	—
N_1 40 lb. Nitrogen/acre/annum ...	2948	590
N_2 80 lb. Nitrogen/acre/annum ...	3607	1,249
N_3 120 lb. Nitrogen/acre/annum ...	4187	1,829

It will be seen that the response to application of nitrogen is very marked indeed. If one assumes conservatively that the net profit to the grower from each pound of made tea is normally 30 cents then it may be calculated that in this trial the outlay of each additional dollar on fertiliser has resulted in a minimum additional nett income of three dollars.

347. A tea pruning and disease control experiment laid down in 1953 is nearing the end of its second cycle. In this trial hard, medium and light pruning represent the main treatments and plots are split for fungicidal treatment following recovery from pruning. Information of value will not be obtainable until 1960 when accumulated yield data for the whole cycle can be examined.

348. Tea established in 1958 in observation blocks on fine sandy clay loam and deep peat soils at the Federal Experiment Stations, Jerangau and Jalan Kebun, respectively have been maintained. Growth of tea at the Federal Experiment Station, Jerangau, is most encouraging and despite minor leaf and root disease problems this crop may have considerable potential for development of the area. Simple observations designed to determine the relative suitability of a number of cover crops for use in the district with lowland tea have been put down.

349. Growth of tea on deep peat soil at the Federal Experiment Station, Jalan Kebun, has not been entirely satisfactory. Investigations are being planned with a view to determining the nutritional requirements of tea on this soil type as the possibility of raising tea on deep peat soil is of considerable importance in view of the very large acreage of unused peat land in Malaya.

(E).—*Coffee*

350. An important experiment is being carried with Liberian coffee grown on deep peat soil at Jalan Kebun. This experiment is designed to clarify the simple and combined effects of three levels of potash, and 0 and 1 levels of both nitrogen and application of surface mulch; all at three differing soil pH regimes. The trial is just over a year old and to date the only noticeable treatment differences lie in the high casualty rate experienced in mulched plots. It would seem that the mulch attracts termites which in turn damage the young trees.

351. An Arabica coffee variety trial at the Federal Experiment Station, Cameron Highlands, has been maintained. Two varieties namely Mysore and Blue Mountain are compared and Mysore continues to provide a higher yield.

352. Blocks of Robusta and Liberian coffee have been established at the Federal Experiment Station, Jerangau, in Trengganu. These blocks have been planted with a view to providing information on the relative economic values of the two types of coffee both of which are currently grown in this State.

(F).—*Oil Palm*

353. Existing agronomic field trials and those being managed for the Botany Division have been maintained but no new investigations have been put down. The growth of oil palm at the Federal Experiment Station, Jerangau in Trengganu, is excellent and it is considered that oil palm is a most suitable crop for this district.

354. At the Federal Experiment Station, Serdang, results from a long term trial designed to clarify the relative merits of replanting and under-planting oil palm continues to indicate that replanting is preferable. Differences in growth and yield between replanted palms and those planted one, two or three years before felling are still noticeable eight years after planting was carried out. Differences, however, are less marked than was the case in earlier years.

355. An appraisal of results from a long term manurial trial carried out on an estate in Lower Perak suggests that economic benefits are obtainable in that locality as a result of applying rock phosphate alone at 206 lbs. per acre. Application at twice this rate increases yield still further but the increase does not justify the additional financial outlay unless applied in conjunction with muriate of potash at 49 lbs. per acre. The combined application of rock phosphate at 412 lbs. per acre and muriate of potash at 49 lbs. per acre has produced very profitable increases in yield.

(G).—*Cacao*

356. The incidence of leaf yellowing, necrosis and die-back of branches which in 1958 reached alarming proportions was not as serious in the current year. It is considered that this is a direct reflection of the lower rain precipitation during the period of the 1958/59 North-East monsoon, assisted possibly by the increased use of limestone. The use of the latter is recommended as a means by which the recognised deficiency of calcium can be corrected. Growth and yield of cacao remains far from satisfactory. Yield data of amelonado cacao is as follows:

Yield of Amelonado Cacao in lb. Dry Beans/Acre
(Conversion factor 100 pods=8.5 lb. dry beans)

Age of Trees	Expected Yield	Actual Yield				
		Federal Experiment Station Serdang		Federal Experiment Station Jerangau Seed Garden		
		Fd. 44A and B	Fd. 46A	A	B1	C
4th year ...	150 lbs.	199	296	162	31	13
6th year ...	400 lbs.	127	253	319	178	123
7th year ...	550 lbs.	226	408	385	294*	275*
8th year ...	700 lbs.	121	147	567*	—	—
9th year ...	850 lbs.	246*	311*	—	—	—

357. The failure of yields of cacao to reach expectation or even to achieve a level compatible with possible economic production resulted in 1958 in withdrawal of departmental support for further cacao planting in Malaya. This situation remains unchanged. A bid has been made for recruitment from F.A.O. of an expert to study the problem of cacao nutrition.

358. Existing agronomic trials have been maintained. An important manurial trial Tr. 32 which examined the nine factorial combinations of rock phosphate and magnesium limestone, each absent and at single and double levels of application continues to demonstrate that response to phosphate is a curvature effect while that to magnesium limestone is near linear. There is a complimentary effect at single levels of each which is not found at the double level. Plots in this trial have been split for the presence and application of potash and maganese, the former applied as a soil dressing as sulphate of potash and the latter as a foliar spray. There is no evidence of either treatment influencing vigour or incidence of die-back. A repeat trial Tr. 51 identical to the trial Tr. 32 described above has failed to confirm the findings from the original trial. The repeat trial was put down in 1957 and future developments in this trial will be of considerable interest. In the original lime phosphate trial Tr. 32 further analysis of foliage has provided the following information:

* Yield in 1959

Nitrogen—

Uptake increased by application of either rock phosphate (significant only at 5 per cent level) or magnesium limestone (significant at 1 per cent level) but application of one in the presence of the other produced no further increase in uptake.

Phosphorous—

Uptake increased by application at the single level of rock phosphate (significant at 5 per cent level) with no further increase at the double level, but uptake decreased linearly by successive increases in level of magnesium limestone (significant at 1 per cent level).

Potassium—

Uptake markedly increased by application of sulphate of potash (significant at 0.1 per cent level). Uptake decreased by application of magnesium limestone (significant at 0.1 per cent level) and rock phosphate (significant at 1 per cent level) but application of one in the presence of the other produced no further decrease in uptake.

Calcium—

Uptake increased slightly by application of magnesium limestone and rock phosphate (both significant only at 5 per cent level) but application of one in the presence of the other produced no further increase in uptake.

Magnesium—

Uptake decreased by application of sulphate of potash (significant at 0.1 per cent level). Uptake increased by application of magnesium limestone at single level (significant at 0.1 per cent level) with no further increase at the double level. Uptake decreased by application of rock phosphate (significant at 5 per cent level).

Manganese—

Uptake increased by application of magnesium limestone at the single level (significant at 5 per cent level) with no further increase at the double level. It is not influenced by foliar application of manganese sulphate.

Iron—

Uptake decreased by both rock phosphate and magnesium limestone both (significant at the 5 per cent level).

359. A 2⁵ factorial manurial trial involving the elements N.P.K. Ca and Mg on mature cacao has been in hand for two years at the Federal Experiment Station, Jerangau. A similar trial is being conducted on young cacao at the Federal Experiment Station, Serdang. In neither case has a response been obtained which has not been provided from other trials, however analysis of foliage from the trial Tr. 38 in Trengganu has provided information as follows:

Nitrogen—

Uptake is increased by application of magnesium limestone (significant at 1 per cent level) and sulphate of potash (significant at 5 per cent level).

Phosphorous—

Treatments have produced no logical effects.

Potassium—

Uptake of K_2O is markedly increased by application of sulphate of potash (significant at 0.1 per cent level) and increased slightly by application of rock phosphate (significant at 5 per cent level). Uptake is decreased noticeably by the use of magnesium limestone (significant at 0.1 per cent level) and slightly by Kieserite (significant at 5 per cent level).

Calcium—

Uptake of CaO is increased noticeably by application of magnesium limestone (significant at 0.1 per cent level) and decreased by Kieserite (significant at 1 per cent level).

Magnesium—

Uptake of MgO is decreased by use of magnesium limestone (significant at 5 per cent) and also by sulphate of potash (significant at 0.1 per cent level) and rock phosphate (significant at 5 per cent level). It is increased by application of Kieserite (significant at 0.1 per cent level).

360. A simple investigation has been initiated at the Federal Experiment Station, Jerangau, which is intended to clarify whether a growth response might be achieved as a result of the application of foliar sprays. Solutions prepared from seaweed extracts are compared with complete nutrient solutions of inorganic origin. No noticeable response to treatment had been achieved at the end of the year.

361. An investigation was laid down in 1958 to clarify the effect on growth and health of cacao of clean weeding, mulching and allowing the fields to remain under natural weed growth. The mulching treatment would seem to be beneficial but as yet it has had no marked effect on the incidence of leaf yellowing and die-back. The use of herbicides for eradication of ground weed and particularly grasses has been further examined. Commercial preparations of the sodium salt of 2,2-Dichloropropionic acid have adversely affected the health of cacao at all concentrations required to kill grass. Sodium chlorate used at 20 lbs. per acre continues to be a satisfactory herbicide and has no ill effect on the cacao. Doubling the rate of application of sodium chlorate caused slight scorching of the cacao but it is neither desirable nor necessary to use the product at this concentration. The mixed esters of 2,4D and 2,4,5T used at concentrations sufficient to kill weed growth caused yellowing and necrosis of the foliage and cannot be considered as suitable herbicides for use in cacao fields.

362. A pruning observation at the Federal Experiment Station, Serdang, has been continued. In this investigation the pruning technique aims at ensuring development of a single trunk of about 5½ ft. to 6 ft. tall carrying a single storeyed canopy. The development of unpruned trees is not controlled in any way. Yield data in 1959 which was the second bearing year indicated that while in the case of the unpruned Amelonado the yields exceed those of the pruned trees, differences have disappeared in the case of the more vigorous Upper Amazon. In view of the ease of access among pruned trees and the benefits associated with this, the formative pruning of young cacao is generally recommended and a paper has been produced describing the technique.

363. The Cameroon type cocoa drier at the Federal Experiment Station, Jerangau, continues to operate satisfactorily. Bulk shipments of dried fermented beans from both the Federal Experiment Station, Jerangau and Serdang, produced favourable comment on the London market and yielded satisfactory financial returns.

(H).—*Vegetable and Food Crops*

364. Production of vegetables at high elevation at Cameron Highlands represents a major contribution to the total vegetable production of the Federation of Malaya. It is traditional among vegetable growers in the district to use prawn dust for manuring, however this attracts flies which are a danger to health. A long term trial at the Federal Experiment Station, Cameron Highlands has, over six cropping cycles, indicated that substitute mixtures containing either bean cake or Sterameal Black Label, supplemented with inorganics, are capable of maintaining or even increasing yields. This evidence is further confirmed by results obtained in 1959 and it is in consequence reasonable to conclude that the use of prawn dust as a manure can be discontinued and the farming community can be invited to use substitute mixtures which are both cheaper than prawn dust and—in the case of the mixtures based on Sterameal Black Label—less of a liability to the health of the community.

365. An important aspect of the current investigation programme at the Federal Experiment Station, Cameron Highlands, has been the finding of a variety of potato (*Solanum tuberosum*) which has proved to be highly resistant to blight (*Phytophthora infestans*). The variety is named Van Haeringen 52-03 and is of good quality. In a variety trial in which imported seed was used, it yielded the equivalent of 8.6 tons of tubers per acre which was considerably greater than the yield from other imported varieties or local material. Repeat trials have been put down in order to obtain further information on the performance of once grown seed.

366. A preliminary investigations designed to clarify the optimum spacing of potato (*Solanum tuberosum*) suggests that close spacing is desirable, the highest yield of tubers was obtained with rows 24 in. apart with tubers 10 in. apart in the row. An

investigation is in hand to clarify which periods of the year are most suitable for planting potatoes in the highlands.

367. In the lowlands a long term observation designed to clarify the effect of continuous arable cropping has been continued at the Federal Experiment Station, Serdang. In this investigation the effect in terms of crop yield and soil fertility of continuous arable cropping is compared with an alternate system of two years arable cropping and two years production of fodder grass. Each main treatment is subdivided so that in each case half the area receives an inorganic fertiliser supplement.

368. The investigation is in its seventh year and the guinea grass was ploughed out in 1957. Yields for the 1958/59 season are as follows:

Calculated Yield in Lb. Per Acre of Dry Grain, Fresh Tubers or Shelled Nuts

Year	Crop	Continuous Arable Cropping		Alternate Husbandry	
		Without Inorganics	With Inorganics	Without Inorganics	With Inorganics
No. 8 1958-59	Maize ...	520	1,128	608	1,280
	Sweet Potato ...	10,824	17,456	11,704	12,695
	Groundnut ...	912	560	584	744

369. Yields of maize and sweet potato reflect the benefit which is to be expected from the use of Fertiliser supplement. The comparative yield pattern for areas under continuous arable cropping and alternate husbandry is not clear furthermore the average yield of sweet potato is lower, although this may be a seasonal effect. Yield pattern of the groundnut is erratic and has not been explained.

370. A series of maize variety trials have been conducted at the Federal Experiment Station, Serdang, since 1957. These trials are designed to test the comparative values of five imported varieties—three of which are hybrids—with local flint. Statistical examination of the data is still incomplete but the Australian hybrid GH 211E has consistently outyielded all other varieties.

371. A series of simple groundnut variety investigations have been put down in the more important groundnut growing areas in the Federation. The test plots are intended to provide preliminary data on the performance of eight selected varieties of groundnut in various districts. They are intended also to indicate whether or not major yield differences can be expected as a result of using limestone.

372. Three varieties of hybrid sorghum were imported from the U.S.A. for testing both as forage and grain crops. Three cuts of fodder were obtained which gave a total yield equivalent to over 21 tons of fodder per acre from manured plots and 13 tons per acre when the crop was not manured. No major varietal differences were recorded. The crop when grown for grain is susceptible to bird damage. One variety produced many sterile ears however yield of grain from the remaining varieties was over 4,000 lbs. per acre from manured plots and approximately 3,000 lbs. per acre when the crop was not manured.

373. Numerous varieties of vegetables obtained from Japan, India and the U.S.A. have been tested in the lowlands. A number of promising varieties of lettuce were obtained but in the case of all other types of vegetable no variety proved to be better than those in normal use.

(I).—*Fodders and Pastures*

(i) *Fodder Crops*

374. A three factorial manurial trial on Guinea grass at the Federal Experiment Station, Serdang, has now completed the three year period which it was intended to run. It is designed to test the effect on yield of post establishment application of cattle manure, NK fertiliser and rock phosphate in various combinations and to ascertain in particular whether any set of treatments could be expected to reduce the marked fall in yield after the first year which is characteristic of the production of guinea grass in Malaya. Examination of the results indicates that in approximate figures the NK treatments increased yields from 27 tons of cut grass per acre per year to 42 tons per acre per year and cattle manure similarly increased yield from 28 tons per acre per year to 41 tons per acre per year. The response in both cases was linear over the two increments. The interaction of these two treatments was significant and in the presence of cattle manure the response to application of the double dressing of NK fertiliser produced a yield increase of eight tons per acre more than was achieved in its absence. The overall mean yield pattern showed the expected linear decline from the 1st to the 3rd year from 44 tons per acre to 25 tons per acre. The linear effect of the two increments of NK fertiliser declined from 18 tons in the first year to 12 tons in the third year, however the linear effect of the cattle manure increased from 1st to the 3rd year from $12\frac{1}{2}$ tons in the first year to $15\frac{1}{2}$ tons in the third year. There was no evidence of the interaction between NK and cattle manure changing throughout the three years although the figures suggest an increase.

375. Interesting results are being obtained from a guinea grass variety and spacing trial at the Federal Experiment Station, Serdang. Eight cuts were taken in the first complete experimental year and several of the strains imported from East Africa have outyielded the local material although in many cases the food value of the grass is comparatively poor. The most promising variety is Tanganyika (short) which is both high yielding and produces material of high feed value. Both tanganyika and the Serdang or local strain are consistently late flowering.

376. Ten strains of various species of fodder grass have been provisionally selected from collections of imported material maintained at the Federal Experiment Station, Kuala Lumpur. Selection is based on vigour and yield and the selected varieties are being subjected to more detailed testing. Examination of the yield of *Brachiaria brizantha* selected some years ago indicates that the yield drops away in the second year as is the pattern with guinea grass. *Brachiaria brizantha* however is markedly persistent and has stood up well to regular strip grazing over a

two year period. Seed of an allied species *Brachiaria ruziziensis* has recently been imported for testing.

377. Russian Comfrey, *Symphytum perigrinum* continues to produce high yields of nutritious palatable fodder at the Federal Experiment Station, Cameron Highlands. This crop is liable to seasonal infection with Bacterial wilt but despite this it is considered to be promising. Twelve varieties of lucerne (*Medicago sativa*) have been imported from the U.K., U.S.A., Spain and the Argentine. These varieties which are considered to be the most suitable for use in the tropics have been sown in Kelantan, Kuala Lumpur and at Cameron Highlands but have been a complete failure as a fodder crop at all sites. Attempts to grow this crop are to be repeated following inoculation with bacterial culture.

(ii) Pastures

378. The NPK 3^3 factorial pasture manurial trial in progress at the Federal Experiment Station, Serdang, is now regularly and systematically grazed by Bali Cattle. This trial is under the shade of rain trees, *Enterolobium saman*, and evaluation of manurial effects using grazing animals is not feasible with the existing layout. Sample cuts from each plot are made immediately prior to each grazing round however and the yield data so obtained serves to suggest that there is still a noticeable response to application of nitrogen but not to phosphate. There no longer appears to be a response to application of potash.

379. Grazing of the pasture shade and variety trial at Serdang with cattle has been maintained. Yields of grass calculated by cutting sample strips immediately prior to grazing gave the following yields:

Estimated Yield in Tons of Cut Grass Per Acre

Grass Species		Shade		No shade
<i>Axonopus affinis</i>	...	9.2	...	7.9
<i>Axonopus compressus</i>	...	11.8	...	7.5

380. Stocking rate during the year remained unchanged at approximately 2.5 head per acre but the rate of application of fertiliser has been stepped up.

(2).—LIVESTOCK

(A).—Pigs

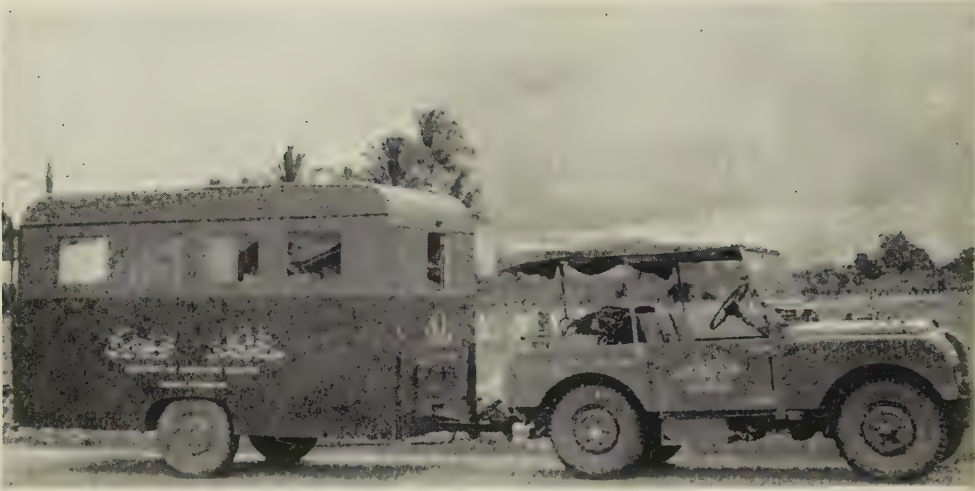
381. A pig feeding trial at the Federal Experiment Station, Serdang, is designed to test the relative merits of feeding a high concentrate ration with a cheaper local modification of a system of rationing designed by "Lehmann". Fourteen replications have been attempted but the last three unfortunately had to be abandoned on account of bad doers at various stages in the course of the trial. This could have been avoided by adopting method of individual feeding and to effect this appropriate facilities are being sought for future trials. Results from the trial to date suggest that the cheaper system of feeding is not disadvantageous in terms of growth rate, carcase quality of efficiency of food conversion.



Stylosanthes gracilis (Stylo), seven months after planting, left to grow as uncut monsoon fodder, Bukit China, Kelantan

Stylo, six months after planting on very poor sandy coastal soil (*bris*), Kelantan





The Kelantan Department of Agriculture
Mobile Extension Unit, ready to move off

The Kelantan Mobile Extension Unit
erected and ready for visitors or lectures



382. The excellence of the half bred Middle White x Chinese Black for pork production has been appreciated by pig farmers in the post war years. There has unfortunately been a tendency to use the half bred animals for breeding purposes and this besides being an undesirable practice has resulted in so serious a contamination of the Chinese Black with exotic blood, that there is a danger of this breed being lost. A programme of selection and the establishment of breeding herds of pure line Chinese pig has been initiated during the year and the first stage of the selection programme is well in hand.

(B).—*Cattle*

383. The Bali herd at the Federal Experiment Station, Serdang, has been maintained in good health. This breed of cattle are said to be descended from a species of wild cattle known as *Bos banteng* which are native to the forests of Malaysia. An information paper has been produced outlining the performance of these animals. Investigations have served to suggest there is no economic advantage to be gained by feeding concentrate to these animals. It has been shown that the average gestation period from 64 calvings is 287 days, the shortest recorded period being 275 days and the longest 310 days. Conception rates compare favourably with figures quoted in other countries with other breeds of cattle but natural mating between Bali cattle and cattle of other species while possible is difficult.

384. Meat colour and texture tends to be slightly inferior to that obtained from European breeds of cattle, lacking marbling and possessing coarse muscle fibres. The killing out percentage seems to be lower than that obtained from beef bullocks of European breeds.

C.—EXTENSION AND ADVISORY WORK

1.—CROPS

(A).—*Rubber*

385. The area of rubber smallholdings in the Federation is estimated to be about 1.6 million acres although this figure is probably rather a conservative estimate. The Field staff of the Department of Agriculture maintained close co-operation with the staff of the Smallholders Advisory Service of the Rubber Research Institute of Malaya to ensure that the smallholders were kept advised of the latest techniques of maintenance, adopting weed, pest and disease control as well as anti-erosion measures and fertiliser application.

386. The Director of Agriculture continued as the Executive Officer of the Rubber Industry Smallholders Planting Material Scheme, 1956, the Field Branch of the department being in direct charge of the production. The object of this scheme is to produce high yielding planting materials for use by the smallholders participating in the rubber replanting scheme and also for those undertaking new planting. The approved planting materials produced included Tjir 1 clonal seedlings and budwood of the recommended clones of Tjir 1, PB 86, RRIM 501, RRIM 513, G 1 and PR 107.

387. In 1959, there was a keen demand for both types of planting material and there was a substantial increase in the materials used when compared with the previous years. While the use of clonal seedling stumps increased, the swing towards the use of budwood continued to be marked and there was a large increase in the use of budwood during the year.

388. The distribution of approved planting material during the last five years is as follows:

Year	1955	1956	1957	1958	1959
Budwood (yards)	109,110	191,883	258,834	271,470	355,878
Clonal seedlings	5,446,689	10,412,173	9,128,563	9,195,539	10,991,799

389. The breakdown of the distribution of planting materials during the year between new planting and replanting is as follows:

	Budwood (Yard)		Clonal Seedlings
For new planting ...	147,604	...	2,621,903
For replanting ...	208,274	...	8,369,896

390. Progress with new and replanting by smallholders during the last five years is shown in the following table:

Year		New planting (acres)		Replanting (acres)
1955	...	8,100	...	28,900*
1956	...	13,100	...	49,870
1957	...	11,300	...	52,478
1958	...	10,800	...	59,694
1959	...	n.a.	...	76,720

391. Purchase of seed for the 1959/60 season began in August with a target for 5.1 million seed and although the seedfall during the year was not good, particularly in the northern part of the country, the requirements were obtained before the end of the year. The establishment of clonal seedling nurseries was on a much reduced scale compared with the previous years in view of the surplus of clonal seedling in 1958/59 nurseries, which will be carried forward for use in 1960.

392. The germination of seed supplied during the year was satisfactory, about 65 per cent of the seed supplied being transplanted into nurseries. By the end of the year, some 3.6 million seedlings had been established and were growing satisfactorily.

(B).—Padi

393. The policy of Government to close the gap between production and consumption of rice, the staple food of the country, has been pursued and the accent has been placed on achieving this target of self-sufficiency by increasing production from existing padi lands rather than by opening up new lands for padi cultivation. Some small expansion of the area under padi cultivation is however possible and in 1959 an increase of 13,000 acres over the previous year was recorded through bringing into cultivation certain previously abandoned areas.

* Amended figure.

394. Yields per acre can be increased in the following ways :

- (a) By the provision of improved drainage and irrigation facilities.
- (b) By the expansion of the area under double-cropping wherever the irrigation supply is sufficient.
- (c) By the adoption by farmers of better farming practices including the use of ripe and plump seed, larger and manured seedling nurseries, transplanting of the seedling at the right age, use of correct spacing of plants in the padi field, shallow planting of seedling, regular weeding, harvesting at the correct time and rotation with dry land crops in the off-season.
- (d) By the full and economic use of all types of manure, both organic and inorganic, including the manuring of seedling nurseries and of the transplanted seedlings in the field.
- (e) By the use of pure strain seed of improved varieties.
- (f) By the effective control of pests and diseases and especially rats, stem borers, and sucking bugs.

395. The improvement of irrigation and drainage facilities is the concern of the Drainage and Irrigation Department whose staff works in close liaison with that of the Department of Agriculture. Of the other methods of yield improvement, the use of fertilisers is one that can give the most rapid results. The extension branch of the department continued to give this aspect of cultivation high priority in 1959 and more than 1,800 demonstrations were laid down throughout the Federation. Manuring of nurseries with ammonium phosphate 11:48 gives very economic responses over a wide range of conditions throughout the Federation and over 1,100 of the manurial demonstrations were concerned with this type of fertiliser. Yield increases of up to 159 gantangs per acre were recorded from these demonstrations. Field manuring was demonstrated at over 700 sites and although responses are less uniform, increases in yield ranging up to 240 gantangs per acre were recorded. It is becoming increasingly evident that the full benefit of the fertilisers cannot be realised unless their application is accompanied by much improved husbandry techniques and these improved techniques are now being incorporated in all demonstrations.

396. There was a very marked increase in the quantity of commercial fertilisers used for padi during the year. It is estimated that nearly 10,000 tons of fertilisers of seven types were used in addition to some 12,700 tons of bat guano which is traditionally used, mainly in Kedah and Perlis. These fertilisers are used both as basal dressings and as top dressings. The basal mixture used varies from State to State but is usually a mixture of phosphate in the form of C.I.R.P. or superphosphate, muriate of potash and nitrogen as sulphate of ammonia. The top dressing is usually urea alone although in the East Coast the complete NPK mixture was also used as a top dressing. Urea was used on a large scale for the first time during the year, 1,425 tons being distributed for the top dressing of padi crops. Almost all of this fertiliser was

distributed through the Co-operative Societies who are encouraging its use by the provision of reasonable credit terms and who have thereby been largely instrumental in popularising its use. This fertiliser when compared with the sulphate of ammonia has the distinct advantage of reduced bulk per unit of nitrogen, which is particularly important in the transporting of the fertiliser to the padi fields.

397. The amount of ammonium phosphate 11:48 distributed for nursery manuring was disappointingly small. Although an economic response is almost invariably obtained from the use of this fertiliser, the amount used during the year was only 34 tons. Demonstration alone is clearly not enough to achieve widespread adoption of the nursery fertilising technique and intensification of this campaign is necessary. Supplies are not easily obtainable in all districts and because of this the practical value of the demonstrations is reduced.

398. Subsidised padi fertilisers were available in four States. Approximate sales in those States and in Kelantan where the subsidy scheme has been discontinued are as follows:

State	SALES IN TONS		
	1957	1958	1959
Trengganu ...	371*	472	666.6
Negri Sembilan	219*	263	176
Malacca ...	88	93	150
Johore ...	24	57	90
Kelantan ...	1,399*	1,710	3,049 (unsubsidised)

399. In Trengganu, although the subsidy amounted to only \$1.00 per 100 lbs. bag, the quantity distributed was nearly 200 tons more than when higher subsidies were provided during the previous year. In Kelantan where there was no subsidy in 1959, a record quantity was used, being almost double the 1958 figure of subsidised sales. In these two States the educational value of fertiliser subsidy schemes is clearly demonstrated. In other States in the Federation the use of fertilisers mainly rock phosphate and urea increased considerably during the year, Perlis, Kedah, Penang and Perak showing the greatest increases in the fertiliser used.

400. In 1958/59 the average wet padi yield was recorded as 326 gantangs per acre compared with the 358 gantangs per acre during the 1957/58 season. This reduction in yield was mainly due to late planting necessitated by abnormal weather conditions and to the effect of severe drought. The adverse effect of the weather was however to some extent offset by the more widespread adoption of improved cultural practices resulting from the continued campaigning by the extension branch of the department.

401. In Tanjong Karang, Selangor, the highest yielding area of the country, an average yield of 613 gantangs per acre was obtained from 24,790 acres. Individual cases of outstanding yield were also reported in many parts of the country.

* Corrected figure

402. The area under double-cropping expanded from 7,290 acres in 1958 to 11,640 acres in 1959. In Province Wellesly and Kedah where double-cropping has been practised for some time increased areas were double cropped. Double-cropping was also done in Kelantan, Trengganu and to a lesser extent in Perak. In Kelantan and Trengganu, 1959 was the first successful attempt at double-cropping. Intensive campaigning was necessary in these States to achieve the co-operation of the farmers. Various series of meetings and discussions with the local leaders and subsequent conducted visits to established double-cropping areas were organised to convince the cultivators of the practicability of double-cropping. In Trengganu double-cropping was undertaken by a Farmers' Association which was sponsored by the Department of Agriculture in order to achieve the necessary organisation and co-operation amongst the cultivators. In this initial year assistance was given in the form of seed supply, fertilisers and pest control services and there are indications that in introducing double-cropping to a new area, it may be necessary to organise the collective preparation of nurseries where a high standard of general management and of pest and disease control can more easily be achieved.

403. The average yield of double-cropping in Kedah was the highest in the country at 543 gantangs per acre. Kelantan averaged 505 gantangs per acre. The overall average yield for the off-season crop was 422 gantangs per acre surpassing the previous record averaging 400 gantangs per acre achieved in 1958.

404. Improved strains of padi are now available for several States and over 37,000 gantangs of selected strains were distributed in 1959, a slight improvement on the previous year's figure of 32,000 gantangs. In Malacca and Negri Sembilan, a system of producing seed padi on contract seed-farms has been practised for some years and the initial steps are now being taken in various other States to adopt a similar system and thus to allow the large scale distribution of improved seed-padi. Seed-padi is also produced on 50 padi test stations scattered throughout the Federation and in Perak where the strain Seraup 50 was released to padi farmers for the first time some 3,000 gantangs were distributed from these stations. Cultivators are encouraged to use these improved selected strains by means of demonstration plots laid down on the cultivator's land using the strain appropriate to the district.

405. The "progressive farmer" technique originated in Kelantan and Trengganu has proved useful in popularising amongst the padi planters the use of fertilisers and of selected padi strains. This technique is now used in most States of the Federation and is considered most valuable in that it allows all aspects of improved husbandry to be demonstrated.

406. The Department continued its pest control service during the year supplying to the cultivators mainly rat poisons and insecticides.

407. The need to bring security to paid cultivators has long been recognised as a necessary step to encourage them to adopt

improved cultivation techniques. In an endeavour to achieve this, the padi cultivators (Control of Rent and Security of Tenure) Ordinance, 1956, was introduced. In Kedah where the Ordinance was adopted, its effectiveness has steadily declined and during the year only 4,000 agreements between the tenants and land-owners were registered under the Ordinance compared with the 5,873, 5,583 and 5,000 agreements registered during 1956, 1957 and 1958 respectively. It is evident that this Ordinance cannot be effective without the setting up of an appropriate Authority to ensure its enforcement.

408. The Kedah Padi Planters' Association participated in the extension activities of the department by assisting in the distribution of advisory leaflets.

409. The Kedah Padi Planters' Board continued its redemption of mortgages and usufructuary loans benefitting during the year 151 people, the Board also bought rubber land for resale to its members and 20 people benefitted in this way. This latter activity is considered to be valuable as it contributes to the lessening of popular pressure on the padi lands. The Padi Planters' Board of Pahang which was established some years ago has been inactive. During the year a Padi Planters' Board was established in Selangor. The Perlis Padi Planters' Board issued loans of \$6,750 for the purchase of buffaloes, \$370,000 for the purchase of fertilisers and \$99,652 for the redemption of "jual janji".

(C).—Coconut

410. The main problems facing the coconut smallholding are the deterioration of internal drainage, heavy growth of weeds, chiefly lallang and bamboo grass and in many cases a stand of trees per acre which is well below the optimum. Maintenance has in fact deteriorated in past years to such an extent that improvement of the holdings is generally beyond the financial means of the smallholders themselves. Provision of loan funds from the Planters' Loan Board has made possible the improvement of a certain number of smallholdings but such a system is of necessity very limited in its application. It appears, therefore, that a more widespread financial assistance will have to be provided if any significant improvement in the coconut smallholdings is to be achieved. This is particularly desirable on the West Coast of Johore where the palm population is generally quite inadequate. There is, however, a need for a more intensive study in this area, chiefly to investigate the soil conditions in these areas before such a scheme can be formulated. Control of the coconut beetle (*oryctes rhinoceros*) also requires further investigation as this pest is likely to be the most serious difficulty to be overcome if large scale replanting were to be considered.

411. The main problem on the East Coast is the low fertility of the bris soil, a considerable acreage of which is now planted with coconuts of poor growth and very low yield. Manuring with locally available inorganic manure together with inorganic fertilisers has been shown to improve the condition and production of these palms and such manuring is being encouraged



Extensive view of rubber budwood nurseries
at Federal Experiment Station, Serdang

Rubber, eight months
after budding, at Serdang





A bunch of well-grown selected Chinese gilts at the Federal Experiment Station, Serdang

A Chinese sow with litter of 12 good quality piglets, sired by Middle White boar



although the response by the smallholders is slow. A more practicable way of improving the fertility of the soil in these coconut holdings is the planting of *stylosanthes gracilis* between the palms as a cattle fodder, the cattle manure thus produced being suitable for the palms and this approach is now being investigated.

412. A very marked response in growth has been obtained by the use of organic manure in the establishment of young palms and smallholders are increasingly adopting this technique.

(D).—Pineapple

413. The continuing depressed state of the pineapple industry caused widespread neglect of smallholdings and little or no manuring has been carried out resulting in a great reduction in the number and size of fruits. The low price of 2½ cents per lb. of fruit has made it virtually impossible for smallholders to be in a position to incur expenditure on fertilisers or on maintenance work.

(E).—Fruit

414. The total number of budded fruit plants distributed during the year was only 56,484 compared with 63,665 in 1958. Of this number, over 40,000 were budded rambutans. These plants are produced both from nurseries under departmental management and from commercial nurseries under the supervision of the department. There are now three such commercial nurseries in Perak. In Selangor and Johore the production of budded plants is undertaken by contractors. There have been sufficient budded rambutans available throughout the year to meet the existing demand in full. The reduction in the numbers produced therefore reflects a decreased interest in the planting of these fruit trees. Distribution in recent years was as follows:

	1953	1954	1955	1956	1957	1958	1959
Budded trees							
distributed ...	26,781	39,898	50,582	58,246	57,996	63,665	56,484

415. An important development in fruit production during the year was the increased interest in the planting of citrus mainly limau chembol in North Malaya. Some 1,200 limau chembol seedlings and 2,800 mandarin oranges were planted by the smallholders in both the North-East and the North-West of Malaya. Encouragement was continued towards the improvement of maintenance standards of the fruit smallholdings and demonstrations of manuring, pruning and general maintenance were carried out on smallholders land. Techniques of fruit tree establishment are also being demonstrated on farmers' land where old unproductive trees of all kind are removed and the land then planted with budded plants according to modern practices.

416. Although considerable areas have been set aside for fruit cultivation within the various land development schemes throughout the country, very little planting has so far been undertaken as in most of these schemes the first stage in development is the planting up of the rubber holdings. However, planning has gone ahead for the production of fruit planting materials to supply

these schemes, some of which are being undertaken by the Land Development Boards concerned and some by the Department of Agriculture.

417. Other miscellaneous planting materials distributed include the following:

Lime	...	...	...	272	plants
Pomelo	...	...	...	233	"
Grapefruit	...	...	...	78	"
Chiku	...	...	...	184	"
Mangosteen	...	...	...	542	"
Duku	...	...	...	567	"
Langsat	...	...	...	227	"
Chempedak	...	...	...	112	"
Nangka	...	...	...	13	"
Caranbola	...	...	...	57	"
Belimbing	...	...	...	30	"
Mango	...	...	...	29	"
Kwini	...	...	...	97	"
Pulasan	...	...	...	51	"
Avocado pear	...	...	...	12	"
Coffee seedling	...	...	...	15,152	"
Coffee bean	...	...	...	45	lbs.
Cacao pods	...	...	...	184	"
Coconut seedlings	...	...	...	1,250	plants
Cashew nuts	...	...	...	120	"
Shade and shrub	...	...	...	1,185	"
Papaya	...	...	...	64	"
Banana	...	...	...	590	suckers
Manila Hemp	...	...	...	140	"
Cinna	...	...	...	90	"
Cordia	...	...	...	9,200	cuttings
Orchids	...	...	...	239	"
Ornamental plants	...	...	...	822	"
Carpet grass	...	...	...	37	bags

(F).—*Amelonado Cacao Seed Garden*

418. The remaining cacao seed gardens were maintained in good condition although most of them showed some signs of die-back. The extension work on cacao was not pursued although the department has continued to maintain contact with commercial estates. The Smallholders Cacao Pilot Scheme under the supervision of the Department of Agriculture and financed by R.I.D.A. made satisfactory progress. Out of a total of 48 acres planted some 4 acres had to be eradicated because of road deviation work but

this area has been replaced by new planting. The total area under commercial cacao is 1,367 acres of which 1,126 acres are in Trengganu and the remainder in Perak.

2.—MECHANISATION

419. The number of commercial contractors in most States has increased and the demand for departmental tractors has considerably lessened.

420. After suitable tests, demonstrations of the Land Master and Kubota small tractors were carried out in several States. In Kelantan both of these tractors performed quite well, particularly the Kubota 6-horse power diesel tractor. These machines can carry out effective cultivation and are well adapted to smallholding work, being inexpensive enough to be within the means of many farmers. A number of these small tractors have already been purchased by more progressive smallholders.

3.—LIVESTOCK

(A).—Cattle

421. The pre-requisites to improve animal husbandry in Malaya are housing and food. While housing is of prime importance as a basis for achieving a general improvement in management, the production of fodder is of great importance in the integration of livestock into any permanent system of agriculture. The production of animal fodder is a major problem which can be illustrated by considering the livestock population in relation to the available arable land. In Kedah there are 87,284 buffaloes and 46,838 cattle while the total area under wet padi is 281,195. In Kelantan there are 139,124 head of buffalo and cattle which are associated with 184,538 acres of padi land, i.e., one animal to every 1.3 acres. Since these animals are maintained chiefly for draught purposes, it is clear that this heavy population is not justified, one animal to every 7 acres being the probable actual requirement for draught purposes.

422. In order to increase the productivity of land, the department's extension programme includes a campaign to increase organic manuring by conserving the cattle manure produced in properly constructed cattle sheds and by cultivating *stylosanthes gracilis* as a cattle fodder. The extension methods used in this campaign were the distribution of advisory leaflets and demonstrations on cattle owners' holdings. At the end of the year it was estimated that over 600 acres of *stylosanthes gracilis* had been established in Kelantan. This extension work has been carried out for some years in Kelantan, but has been introduced into Kedah only in 1959, and it is reported from Kedah that 20 acres of fodder have been established and 33 cattle sheds constructed during the year.

(B).—Pigs

423. The popularity of Middle White boars continued during the year and full use was made of the stud boars available. There are signs, particularly in Perak, that the pig breeders are

beginning to realise the danger of utilising Middle White crossbred pigs for breeding purposes and there has been a resultant decline in the demand for Middle White weaner boars. In 1958, the department began to establish a nucleus herd of good type Chinese Black pigs, the progeny from which will be distributed as breeding sows to the pig breeders. This work continued in 1959 and 23 Chinese black gilts were distributed. The distribution of Middle White weaner boars was just over 200.

(C).—*Poultry*

424. Sales of pure-bred cockerels, pullets and hatching eggs during the year were as follows:

Cockerels	...	...	65
Pullets	...	...	35
Hatching eggs	...	...	944

In addition, 119,371 eggs were sold for consumption.

(D).—*Goats*

425. The department continued to build up stocks of Anglo-Nubian goats at several Agricultural Stations for distribution to farmers. The number distributed is however limited by the small size of the breeding flock. During the year 22 crossbred bucks and 14 crossbred does were distributed for breeding purposes.

4.—PESTS

426. Help in the control of outbreaks of pests is one of the extension services of the Field Branch and in most States specialist gangs are available to give assistance when required. These gangs are equipped with sprayers, dusters and in most States fogging appliances, rat poisons and insecticides are also available for distribution to smallholders. While this arrangement is desirable at present, the ultimate objective of the existing activities in this direction is to educate the farmers to be able to identify important pests and to know how to control them.

5.—NEW VILLAGES

427. Regular advisory visits are made to New Villages by the staff of the department mainly in connection with the pest control, the supply of improved planting material and pig husbandry. Assistance is also frequently given by arranging the bulk purchase of fertilisers for padi or vegetable cultivation.

6.—SETTLEMENT SCHEMES

428. A number of new land development schemes were started during the year. Work on land settlement schemes is now progressing in Kedah, Kelantan, Trengganu, Pahang, Malacca, Johore and Negri Sembilan. Some of these schemes are financed by the Federal Land Development Authority and others by the State Governments. The first scheme to be developed by the Federal Land Development Authority as a Federal Scheme was started at Bilut Valley in Pahang. In this scheme 50 per cent of the settlers

are Malays, 40 per cent Chinese and 10 per cent Indians selected from all parts of Malaya. Under the Block New Planting of Rubber scheme, numerous proposals for schemes have been put forward and a number of schemes were established during the year. The staff of the department undertook initial soil survey and inspection of these areas in Kelantan and inspection has become a major activity of the Field staff in most States.

429. Although the schemes set up for ex-Special Constables in general have been unsuccessful as the colonists have little aptitude or desire for agriculture, some success has been achieved in this direction in Selangor and a new scheme for ex-Servicemen was started during the year in Kelantan.

7.—RURAL AGRICULTURAL TRAINING

430. Agricultural training for farmers and for rural youths was provided at Rural Training Centres in all States of the Federation. In addition, facilities were provided for the training of Service personnel who were about to be demobilised. During the year a start was made in training in practical agriculture for rural women as a result of a popular request for such courses. Women were trained both in Kelantan and Penang. There was also a demand from the aborigine people of Pahang for such training and one special course was arranged for them. During the year, the total number of agricultural courses held at the Rural Training Centres was 136, the duration of these courses varying from 10 days to six weeks. By this means 1,310 farmers, 660 youths, 141 women, 17 ex-Servicemen and 26 aborigines have been trained, making a total of 2,154.

431. In Penang special courses are provided at Padi Stations for padi planters and school boys and at these courses 1,144 padi cultivators and 132 school boys received training in land preparation, selection and separation of padi seed, nursery and field manuring, correct sowing density, transplanting at the correct age and season, optimum field spacing, planting depth and pest and disease control.

(A).—*Newsletter*

432. 10 States produced newsletters during the year. The number of issues in each State ranged from 1 to 4. The total number of issues throughout the Federation was 32, 4 of which are in Chinese. Altogether about 200,000 copies were distributed, of which 40,000 copies were in Chinese. The Malay issues were printed in Jawi but with a view to encouraging the wider use of Rumi and to widening the reading public to include non-Malays, most States have now either changed over to Rumi publications or to publications in both Rumi and Jawi.

(B).—*Lectures, Talks and Civics Courses*

433. Numerous talks and lectures were given by the present staff of the department. These talks are considered to be a very important medium for teaching farmers and for stimulating

discussion on agricultural matters. The talks are usually carried out at mosques, community centres schools and on other occasions when an opportunity can be taken of the presence of large numbers of cultivators. During the running of the Civics courses one of the major topics discussed is agriculture and many such courses were held at Agricultural Stations.

(C).—*Progressive Farmers*

434. The development of the progressive farmer technique which started on the East Coast is now extended to other States. Energetic and adaptable farmers in the rural areas are selected for assistance and have provided valuable demonstrations on improved padi cultivation techniques through rehabilitation, maintenance, fodder production and cattle shed construction. The technique in effect means that departmental efforts are concentrated on a single holding in one district, resulting in a very effective demonstration of improved techniques, which has a great impact on the neighbouring cultivators.

(D).—*Farmers' Associations*

435. The department is encouraging the formation of Farmers' Associations as it is felt that such organisations can be invaluable in arousing the interest of the rural dwellers in progressive agriculture and as an organised medium for the dissemination of technical information. As this is an extension method new to Malaya, the services of an expert in the organising of Farmers' Associations was obtained through the good auspices of the Asia Foundation and this specialist has trained staff in the States of Negri Sembilan and Malacca. The training will be continued during 1960 for officers in the other States. Excellent progress in sponsoring Farmers Associations was made in Trengganu where 17 Associations were registered by the end of the year. The particular achievements of two of these Associations were the successful padi double-cropping in Besut and the construction of a 1,400 ft. bridge leading to a rubber new planting scheme in which the members are participating. Six Young Farmers' Associations were established in Johore and one in each of Perlis and Malacca. It is the aim to sponsor Farmers' Associations in each State and as soon as there are sufficient number of Associations, to form a State Federation of Farmers' Associations. Ultimately, it is hoped that it will be possible to integrate these into a National Federation. The usefulness and effectiveness of these Farmers' Associations in the machinery of extension has been already clearly demonstrated and it is considered that there is every justification for providing staff specialised in this line of work both at State and Federal level.

(E).—*Agricultural Shows and Padi Competitions*

436. Only three agricultural shows, one State and two District, were held during the year. A notable development was recorded in Kelantan where the members of a Young Farmers Club in co-operation with the farmers organised their own agricultural show.

437. Padi competitions were carried out in most States of the Federation and the winners competed in a national competition. It is hoped that these shows will in future eventually be organised and run by the farmers themselves and it is considered that this function could appropriately be performed by the Farmers' Associations, once these are formally established.

D.—CENSUS OF AGRICULTURE

438. At present most of the information concerning the structure and characteristics of the nation's agriculture is not available, particularly in terms of the number of farms as economic operating units as contrasted with ownership holdings. To provide the basic statistics on agriculture necessary for future development plans, the Federation Government decided to participate in the World Census of Agriculture promoted by the Food and Agriculture Organisation of the United Nations in 1960.

439. A Commission for Agriculture Census was set up within the Ministry of Agriculture in August, 1959, consisting of five full-time senior officers, four of whom were seconded from the Department of Agriculture and the fifth from the Department of Co-operatives. The overall planning and execution of the census was under the direction of Mr. T. B. Wilson, the Agricultural Economist who was seconded as Commissioner for Agriculture Census. A sampling expert, Mr. S. Tsukibayashi, was provided by F.A.O. under the T.A.B. scheme, and additional F.A.O. assistance was received in the form of the Regional Census Advisers Dr. C. F. Sarle, Miss J. A. Jones and Dr. Narian, who contributed valuable knowledge on census problems.

440. The Agriculture Department provided all the staff for the two Pilot Survey operations in September and October, 1959, and also most of the supervisory staff recruited for training at the Federal Census Training Centre in December, 1959, preparatory to undertaking the actual census enumeration planned for April, 1960.

E.—AGRICULTURAL EDUCATION

1.—ADVISORY COUNCIL

441. The constitution of the College Advisory Council was revised by the Government of the Federation of Malaya early in the year and the following were appointed members with effect from 20th January, 1959:

The Hon'ble Dato' Haji Mohamed Noah bin Omar
(*Chairman*).

The Secretary to the Ministry of Agriculture.

The Director of Agriculture, Federation of Malaya.

The Director of Veterinary Services, Federation of Malaya.

The Principal, Sultan Idris Training College, Tanjong Malim.

The Principal, College of Agriculture, Malaya.

The Director, Rubber Research Institute of Malaya.

J. C. Mathison, Esq., Representative of the Rubber Producers' Council, Federation of Malaya.

Mr. Chan Hin Cheung, Representative of the Malayan Estate Owners' Association.

The General Secretary, Alumni Association, College of Agriculture.

Dato' Ja'afar bin Mampak, J.P.

The Hon'ble Enche' Hashim bin Awang, J.P.

Mr. Yap Kim Hock, J.P.

The Hon'ble Enche' Ismail bin Yusoff.

Enche' Jamaludin bin Aji.

The Registrar & Bursar, College of Agriculture (*Secretary*).

442. The Federation Government also approved that the advisory functions and duties of the Council should be:

- (i) To discuss and advise upon matters relevant to the well being, maintenance and development of the College.
- (ii) To consider and advise on the annual estimates of the College prior to their submission to the Ministry of Agriculture.
- (iii) To maintain a liaison between the interests of the Agricultural industry, Rubber Research Institute, Rural and Industrial Development Authority, Department of Education and other bodies which make use of the training facilities available at the College and employ College graduates.

443. The Council under the chairmanship of the Hon'ble Dato' Haji Mohamed Noah bin Omar held its only meeting of the year on 25th March, 1959.

2.—ACADEMIC SESSIONS

444. *Diploma Course*. The 1959/60 academic year for the Diploma Course commenced its session on 10th June and the terms in 1959 were divided as follows:

Third Term, 1958/9 session—7th January to 15th April.

First Term, 1959/60 session—10th June to 2nd September.

Second Term, 1959/60 session—23rd September to 23rd December.

445. The academic year did not start with the full complement of students in the First year because of the State elections, which necessitated the postponement of the selection of applicants for the award of Federal Agricultural Scholarships in some States, and the last scholarship student reported for training one week late.

446. *Certificate Course*. Only one intake of 23 Junior Agricultural Assistant probationers was admitted in 1959. The introduction of East Coast agriculture in the training programme

necessitated some changes in the movements of the trainees during the course of their training. The October intake was cancelled on this account, and hereafter trainees will be accepted in January and May of each year.

3.—REGISTER OF STUDENTS

447. The Register of Students on 31st December, 1959 (Appendix I) showed that there were 73 students in the Diploma Course and 43 trainees in the Certificate Course. Also for the first time in the history of the College of Agriculture, three female scholarship students were admitted to the first year of the Diploma Course.

448. Wastage of students was higher than usual. Two Government and one Rubber Research Institute scholars had their scholarships withdrawn at the end of the 1958/9 academic year. Among the first year students one Government scholarship student absconded and one private student resigned during the First Term. Also there were three failures and one dismissal in the Certificate Course.

449. Both the number and standard of applicants for Government scholarships showed an appreciable improvement over the 1958 figures; 323 eligible applicants were received for the 18 Federal Scholarships awarded—an increase of more than 50 per cent over the previous year. Another notable point was the general rise in the standard of education of the Malay applicants. Some of them not only possessed Grade I School Certificates (of which there was none in 1958) but also Higher School Certificate qualifications. Appendix II shows the breakdown of applications for the 1959 scholarships.

450. It is to be regretted that the College has not been able to admit more students from the Rubber Research Institute, other statutory institutions and the general public, owing to the limited hostel accommodation and teaching facilities. These shortcomings have prevail ever since the War despite annual attempts by the Advisory Council to improve matters. Until these problems are solved, the demand for trained men by the agricultural industry is unlikely to be satisfied in the foreseeable future.

4.—TRAINING

451. *Diploma Course.* Theoretical instruction was carried out in accordance with the existing syllabus. Although the bulk of the lectures were undertaken by graduate staff, some instruction in certain less technical subjects was given by underqualified (Agricultural Assistant) staff.

452. Further improvement in laboratory facilities was carried out during the year, and with the better and up-to-date practical aids purchased and installed, the College can, with justification, claim that it has one of the finest Biological teaching laboratories in the country.

453. In addition to prescribed subjects in the syllabus, the Final year students received a series of lectures on Co-operative

Development and Marketing from the staff of the Co-operative Department. Extra curricular studies leading to the Higher School Certificate examinations in Chemistry, Botany and Zoology continued to be given, and became increasingly popular among the Final year students, since the College Diploma is still not a fully accepted qualification for the award of scholarships for higher studies.

454. Continual progress and expansion of the College Farm was made during the year to provide additional facilities for practical instruction. Although students had to undergo a varied and diverse training programme in their field work—from the layout of experimental plots to the processing of farm produce for the market—the emphasis on farm management and economics has always been carried out, where possible, in the running of the College Farm.

455. About 2.5 acres were under padi as compared with 1.7 acres in the 1958/9 season. Half of the acreage was laid down with examples of current botanical and agronomic investigations as carried out on Departmental Padi Stations. The second year students received full instruction on the various techniques necessary for the conduct of such investigations. The other half was planted in accordance with improved and recommended methods of padi production. It can safely be stated here that no student leaving the College should be ignorant and inexperienced in any line of padi investigational and extension work now undertaken by the Department of Agriculture.

456. The total acreage under rubber for practical training was 12 acres, an increase of 1.25 acres of new planting, the clones being PB 86 and PR 107. Thanks to the Rubber Research Institute, students also received advanced instruction on rubber for about two weeks at the Sungei Buloh Experimental Station. All Final year Rubber Research Institute scholars were given extra rubber “duties” in their field work.

457. Practical instruction on other major crops followed the same pattern as in previous years. Students received fundamental training on Coconut, Pineapple, Oil Palm and Cacao.

458. In the orchard section of the College Farm, 6.5 acres were developed and planted up, thus increasing the acreage of this section to about 14.25 acres. Five acres of the new area were planted with various Malayan fruits (durian, jack fruit, carambola, duku, langsung, etc.) to provide more facilities for future training.

459. Horticultural technique in plant propagation (budding, marcotting, etc.) and the pruning of fruit trees were adequately covered in the field work programme of the senior students. The plant house for ornamental plants has been further enlarged and a collection of 1960 plant species maintained.

460. Market gardening was mainly confined to the first year students and a three year planting programme to allow students to plant and study as many types of vegetables and food crops as possible has been drawn up for the first time.

461. Students continued to receive their training on Animal Husbandry at the Stock Farm of the Federal Experiment Station whenever facilities were available. Battery and deep litter systems of poultry management were introduced. Cost of feeding layers averaged 3.5 cents per bird per day—0.5 cents higher than it cost commercial poultry farmers. The growing of more feeding stuffs and a stricter control on waste in feeding should reduce feeding cost to less than three cents per day.

462. The Agricultural Engineering Division of the Agronomy Branch provided facilities and conducted a course in farm mechanisation for all Final year students.

463. Instructional visits on different aspects of practical training were conducted during the year and once again 13 senior students assisted the Kemendore Land Development Scheme, Malacca, in the survey and demarcation of settlers' allotments during the long vacation.

464. Certificate Course. With the opening of the third School of Agriculture at the Lundang Agricultural Station, near Kota Bharu, Kelantan, and the introduction of East Coast agriculture, the organisation of the Certificate Course was finally completed. All the three Schools (Telok Chengai in Kedah, Serdang and Lundang) were in full operation during the year.

465. Extensions made to the Telok Chengai School provided much needed facilities in the management of this centre during the peak training period from June to August and considerably improved the accommodation for female trainees.

466. The syllabus and subjects taught at the three centres remained the same. The teaching of East Coast agriculture, hitherto omitted simply meant the full implementation of the Course syllabus.

467. Advanced lectures on Padi were given by the Telok Chengai staff of the Agronomy Branch and Botany Division. As a step to improve the standard of the Certificate Course, the oral examination in Agricultural Extension was conducted by Departmental Officers as external examiners.

468. Trainees continued to receive sound and adequate training on padi at Telok Chengai. The field work month at the Gajah Mati Agricultural Station was discontinued because similar facilities were available at Serdang.

469. Training on Coconut was withdrawn from Telok Bahru and transferred to Carey Island where better facilities and more qualified staff were made available to the trainees by the management of the Estate, to whom the Department is most grateful.

470. All practical instruction on dry-land crops was taught at Serdang and Jalan Kebun where the usual training course on Pineapple was conducted. In addition to normal field training, an attempt to establish a model dusun holding entirely by the trainees themselves has been introduced at Serdang. Under the supervision

of the staff, the object was to give trainees a more realistic approach to some of the problems involved in such an undertaking.

471. Twenty Diploma Course students and 36 Certificate Course trainees successfully completed their training in 1959. Candidates given appointments after graduation were as follows:

DEPARTMENT OF AGRICULTURE: Employer					Malays		Chinese		Other races		Total	
					DC	CC	DC	CC	DC	CC	DC	CC
(a) Federal	...	...	...	...	1	1	4	—	—	—	5	1
(b) State	...	...	...	...	8	23	2	—	—	—	10	23
Rubber Research Institute of Malaya					—	—	1	—	—	—	1	—
Department of Agriculture, North Borneo	...	...	...	...	—	—	3	—	—	—	3	—
Private Enterprise	...	...	...	...	—	—	1	—	—	—	1	—
Malacca State Government	...	...	...	...	—	1	—	—	—	—	—	1
Johore State Government (a)	...	...	...	...	—	2	—	—	—	—	—	2
Seeking Employment (b)	...	...	...	...	—	9	—	—	—	—	—	9
Total	...	...	...	...	9	36	11	—	—	—	20	36

5.—LIBRARY

472. Invaluable assistance was received from the Asia Foundation which donated more than 150 books to the Students' Library. The last instalment of Government grant of 2,500 provided under Special Expenditure, 1959 was spent on new books. At the end of the Second Term the Library had a stock of 2,095 books.

6.—HEALTH AND RECREATION

473. The students at the College enjoyed better and sounder health in 1959 than in 1958 if the number of student days lost in field work and due to hospitalisation could be taken as a yardstick. The total number of field work days lost during the year was 50 compared to 231 days in 1958. Admission to hospital was reduced to 6 cases and only 29 student days were lost. Previous figures were 9 and 74 respectively.

474. For the first time in its history, the College fielded a Rugby XV to take part in the fixture programme arranged by the Selangor Rugby Union. The astounding success that the hitherto unknown and untrained College team had over their more experienced and highly regarded rivals (the Selangor Club, R.A.F., etc.) during the season was in no small measure due to the excellent coaching given by Messrs. T. R. Dickinson and R. J. R. Barrett and the enthusiasm displayed by the players.

475. The Students' Union also organised the first Inter Varsity-College Games on behalf of the National Union of Federation Students and the students took part in the competition of all the games—rugger, soccer, badminton and hockey.

(a) Assistant Penghulus.

(b) Trengganu Sponsored Students.

DC = Diploma Course.

CC = Certificate Course.

7.—STAFF

476. Mr. Yap Chin Hee, Registrar and Bursar of the College was awarded the Ahli Mangku Negara by H. M. the Yang di-Pertuan Agong, on the occasion of His Majesty's birthday.

477. The Certificate Course staff was fully established during the year with the appointments of the following:

- (i) Enche' Tamin bin Hussin, Assistant Agricultural Officer as Chief Instructor at the School of Agriculture, Serdang.
- (ii) Enche' Abu Bakar bin Mohd. Tahir, Assistant Agricultural Officer as Chief Instructor, School of Agriculture, Telok Chengai.

478. The acute shortage of senior staff at the College remained unchanged throughout the year and the College continued to receive invaluable help from Messrs. Van Thean Kee and Lee Sin Fook, officers of the Department as part-time lecturers in Plant Breeding and Animal Husbandry respectively.

8.—GENERAL

479. There have been so many visits to the College by V.I.Ps. and F.A.O. experts during the year that space in this report does not permit individual mention of the distinguished visitors.

480. Conducting organised visits by school children, Government Departments, voluntary and charitable organisations, etc., round the College campus has been a regular activity of the Field Staff on Saturday mornings.

481. Hostel and catering facilities were again made available to the Social Welfare Department for their Youth Leadership Course in Agriculture during the September holidays. Similar facilities were provided to officers attending the pilot training scheme of the forthcoming Agricultural Census.

F.—PUBLICATIONS AND LIBRARY

1.—PUBLICATIONS

482. The Department's principal publications are the *Malayan Agricultural Journal*, technical bulletins and leaflets in three languages, used in agricultural extension work.

(i) *Malayan Agricultural Journal*

483. Three issues of the *Malayan Agricultural Journal* were published in 1959. They were Vol. 41, No. 4, Vol. 42, No. 1 and Vol. 42, No. 2 (with index). Each issue contained reports on current investigations and extension work, in addition to the following original articles which are listed with the distribution figures for each number.

Vol. 14, No. 4—Special Rice Issue (Sales 469, Free or Exchange 701. Total 1,170)

Review of Methods of Yield Improvement.

Some Effects of Seedling Age on Transplanted Rice. By F. B. Brown.

The Effect of Depth and Movement of Water on the Growth and Yield of Rice Plants. By R. G. Lockard.

Fungicidal Treatment of Padi Seed. By Anthony Johnston.

Vol. 42, No. 1—(Sales 394, Free or Exchange 681. Total 1,075)

Some Biochemical and Technological Studies on Malayan Pineapple, with Particular Reference to the Singapore Canning Variety. By F. N. G. Conaty.

Oil Palm Seedling Blight. By Anthony Johnston.

Some Marketing Experiments with Tilapia Fish. By C. F. Hickling.

Master Farmers of Malaya, IX. Suib bin Mohamed Ali. By Ali Ahmad bin Sulaiman.

Vol. 42, No. 2—(Sales 395, Free or Exchange 730. Total 1,125)

The Rambutan, A Description of the Characteristics and Potential of the More Important Varieties. By C. Whitehead.

Commercial Fruit Nurseries in Perak. By T. R. Dickinson.

Phytophthora Palmivora—A Parasite of Orchids in Singapore. By Aldworth Thompson.

A Description of Existing Practices in the Cultivation of Mandarin Oranges in Telok Anson Area. By R. J. R. Barrett.

Master Farmers of Malaya, X. Yip Wah. By T. Sockalingam.

(ii) *Bulletins*

484. The following Bulletins were published during the year:

Bulletin No. 105, "Reconnaissance Soil Survey of Trengganu", by Wm. P. Panton. (Sales 18, Free or Exchange 117. Total 135).

Bulletin No. 106, "*Patanga Succincta* (L), The "Bombay Locust in Malaya", by H. T. Pagden. (Sales 11, Free or Exchange 179. Total 190).

Bulletin No. 107, "Mineral Deficiency Symptoms of Cacao Grown in Sand-Culture", by R. G. Lockard, P. Vamathevan and S. Thamboo. (Sales 45, Free or Exchange 207. Total 252).

Bulletin No. 108, "Mineral Nutrition of the Rice Plant in Malaya", by R. G. Lockard.

Bulletin No. 109, "Rice Variety Trials in Malaya, 1954-1958", by F. B. Brown.

Bulletin No. 110, "Common Diseases and Pests of Crops in Malaya with Suggestions for their Control", by A. Johnston.

485. Distribution of Bulletins Nos. 108, 109 and 110 will commence in 1960.

(iii) *Leaflets*

486. Agricultural Leaflets are published by the Department for free distribution within the Federation of Malaya, usually in the languages, Malay, Chinese and English. The following were published or reprinted during 1959:

Distributed					
<i>In Malay:</i>					
Vegetable Leaflet "A"	...	...	...	...	558
Vegetable Leaflet "B"	...	...	...	...	558
Patchouli	...	...	...	...	1,482
The Black Beetle	...	...	...	...	2,082
Grow Your Own Vegetables	...	...	...	...	3,378
Pepper	...	...	...	...	984
Duck Keeping	...	...	...	...	2,880
Compost	...	...	...	...	3,354
Soya Bean Products: Tauhu and Taugeh (Distribution of copies will commence in 1960).					
<i>In Chinese:</i>					
Compost	...	...	...	...	1,405
The Coconut Palm (Distribution of copies will commence in 1960).					
<i>In English:</i>					
Ramie	...	...	...	...	345
Patchouli	...	...	...	...	435
Duck Keeping	...	...	...	...	1,082
Oil Palm	...	...	...	...	818
Grow Your Own Vegetables	...	...	...	...	1,070
Coffee	...	...	...	...	1,200
The Coconut Palm (Distribution of copies will commence in 1960).					
					21,631

(iv) *Distribution of Publications*

487. About 310 copies of each issue of the Malayan Agricultural Journal are exchanged for publications of other research organisations, educational institutions, etc. The publications received in exchange are among the most valuable materials in the Headquarters library.

488. The following summary shows the number of back issues of the various publications of the Department distributed during 1959:

	Sales	Free and Exchange	Total
Malayan Agricultural Journal	1,215	3,409	4,624
Malayan Planting Manual No. 2	1	1	2
Special Bulletins	392	1,308	1,700
Agricultural Leaflets (English)	—	5,993	5,993
Poultry Leaflets	—	2,187	2,187
Grow More Food Series ...	—	1,907	1,907
Leaflets in Malay	—	13,350	13,350
Leaflets in Chinese	—	10,566	10,566
Tamil Agricultural Journal ...	—	41	41
Leaflets in Tamil	—	25	25
			40,395

489. The following is a summary of all publications sold and distributed during the year:

	Sales	Free and Exchange	Total
English	2,940	22,370	25,310
Malay	—	28,626	28,626
Chinese	—	11,971	11,971
Tamil	—	66	66
	2,940	63,033	65,973

490. Comparative figures for total revenue received during 1958 and 1959 from the sale of publications and from advertisements are as follows:

	1957	1958
	\$	\$
Sale of publications ...	5,171	8,041
Advertisements ...	1,314	677 (3 issues only)
	6,485	8,718

2.—LIBRARY

491. The Headquarters Library of the Department of Agriculture contains nearly 4,200 books, about 30,760 bound volumes of periodicals and nearly 100 unbound incomplete volumes of periodicals, most of which were issued pre-war and are out of print. In addition, many thousands of pamphlets, leaflets and reprints are in the library. This considerable volume of printed matter accumulated over a period of 53 years, forms one of the largest libraries on tropical agriculture and related topics to be found in world.

492. The growth of the library continued to be rapid during the year. About 530 periodicals were received and 335 of these were circulated to the staff of the Department as they were received. Apart from the regular journals, 609 items of books and pamphlets were received. A number of gaps in the periodical section were filled by pre-war issues supplied gratis by the Rubber Research Institute of Malaya.

493. The question of providing adequate space for books and readers became acute in 1959 and the necessity to expand the present library or to rehouse it entirely was under active consideration.

494. Indexing of serial publications had to be curtailed owing to staff difficulties. Considerable amount of time was taken up by the increased distribution of a vast amount of departmental instructional leaflets to the various States.

495. The Librarian continued his work of supervision and classification of books of the Library of the College of Agriculture at Serdang.

496. Because of the lack of library facilities in the rural areas, steps were taken to build up libraries attached to the State Agricultural Offices, Federal Experimental Stations and Agricultural Training Centres. For this purpose the Librarian visited the places concerned in order to assist with the organisation, etc.

497. Copies of all available publications of the Department were sent to a number of Secondary Schools for the use of teachers and students. By this arrangement, it is hoped to reduce the considerable amount of correspondence from teachers and students, asking for information on agricultural subjects pertaining to Malaya.

G.—SCHEMES

1.—INVESTIGATION INTO MECHANISATION OF RICE CULTIVATION

498. This scheme, formerly known as Colonial Development and Welfare Scheme No. 2225, is now financed by the Government of the Federation of Malaya. Details regarding the progress of the investigation will be found in Section IV B, para. 298 of this Report.

2.—PADI SOILS/WATER EXPERIMENT STATION

499. A provision of \$223,636 was provided in the Federal Estimates, 1959 for Padi Soils/Water Experimental Station (formerly known as Colonial Development and Welfare Scheme No. R. 747) on which field investigation into the effects of various types of water control on the growth and yield of padi would be carried out. This scheme designed to provide more information on the function of water in rice cultivation, should enable improvements to be made in the design of drainage and irrigation schemes and lead to a material increase of rice production. The scheme is administered in close co-operation with the Department of Drainage and Irrigation and commenced in 1956. Expenditure incurred for the year was \$125,427.13.

SECTION V

AGRICULTURAL LEGISLATION

FEES ORDINANCE, 1951

500. The Fees (Inspection and Fumigation of Plants) Order, 1959, came into force on 1st September, 1959, *vide* Legal Notification No. 247/59.

The fees payable under this Order are for inspection and fumigation of plants by the Department of Agriculture.

MALAYAN RUBBER BOARD FUND (RESEARCH AND DEVELOPMENT) ORDINANCE, 1958

501. Appointment made under the Malayan Rubber Fund (Research and Development) Ordinance, 1958:

- (i) The Director of Agriculture was appointed an alternate member of the Malayan Rubber Fund Board to Member, Mr. H. A. L. Luckham, M.C.S., with effect from 15th January, 1959, under Section 3 (4) (d) of the Ordinance *vide* Federal Government *Gazette* No. 565 of 5th February, 1959.
- (ii) The Deputy Director of Agriculture was appointed an alternate member of the Malayan Rubber Fund Board under Section 3 (4) (d) of the Ordinance vice Director of Agriculture *vide* Federal *Gazette* Notification No. 4474 of 5th November, 1959.

A. L. BARCROFT,
*Acting Director of Agriculture,
Federation of Malaya*

TABLE I
DEPARTMENT OF AGRICULTURE, 1959
ORGANISATION AND ESTABLISHMENT BY BRANCHES (EXCLUDING MINOR NON-TECHNICAL POSTS)

RESEARCH BRANCH		AGRONOMY BRANCH		FIELD BRANCH		PUBLICATIONS		EDUCATION		ADMINISTRATION	
1	Assistant Director (Research)	1	Senior Agronomist	1	Assistant Director	1	Publications Officer	1	Principal, College	1	Higher Executive Officer
	Heads of Division, 5	13	Other Senior Officers	6	Senior Officers, Grade "A,"		1 Librarian	4	Senior Lecturers	1	Executive Officer
2	Senior Research Officers, Grade "A,"	5	Non-Professional Senior Officers	1	Senior Agricultural Officer, Grade "B,"			1	Registrar and Bursar	1	Financial Assistant
3	Senior Research Officers, Grade "B,"	1	Assistant Statistician	14	Agricultural Officers		4 Miscellaneous Technical Posts	9	Agricultural Assistant	30	Miscellaneous Clerical Posts
16	Other Senior Officers	1	Executive Officer	1	Agricultural Economist			4	Junior Agricultural Assistants		
1	Executive Officer	15	Agricultural Assistants	1	Personal Assistant			8	Miscellaneous Junior Posts		
2	Experimental Officers	58	Junior Agricultural Assistants	109	Agricultural Assistant Service Scheme Posts						
1	Assistant Statistician	8	Miscellaneous Technical Posts	284	Junior Agricultural Assistant Service Scheme Posts						
27	Agricultural Assistant Service Scheme Posts										
56	Junior Agricultural Assistant Service Scheme Posts										
28	Miscellaneous Junior Technical Posts										
			Posts 102		Posts 417		Posts 6		Posts 27		Posts 33

APPENDIX I

REGISTER OF STUDENTS—DECEMBER, 1959

I DIPLOMA COURSE

3rd Year Students, 1957/60

	Malays	Chinese	Indians	Total
Federal Government Scholars ...	11	4	—	15
Private Students	—	2	1	3
R.R.I. Students in Training ...	2	2	—	4
Singapore Government Scholar ...	—	1	—	1
Sarawak Students in Training ...	—	2	—	2
J.A.A. Perak State Scholar ...	1	—	—	1
	14	11	1	26

2nd Year Students, 1958/61

Federal Government Scholars ...	8	5	—	13
Private Students	—	1	1	2
R.R.I. Students in Training ...	4	2	—	6
	12	8	1	21

1st Year Students, 1959/62

Federal Government Scholars ...	12*	4*	2*	18
Private Students	—	2	—	2
R.R.I. Students in Training ...	6	—	—	6
	18	6	2	26

II. CERTIFICATE COURSE

Junior Agricultural Assistant Probationers:

(i) Federal	13	2	1	16
(ii) State	23*	2	—	25
Brunei Government Trainees ...	2	—	—	2
	38	4	1	43
GRAND TOTAL ...	82	29	5	116

* One female student from each.

APPENDIX II

APPLICATIONS FOR FEDERAL AGRICULTURAL SCHOLARSHIPS, 1959 (18 Scholarships—15 for Boys and 3 for Girls)

STATE	Applicants						Grade				Grade I				Grade II			
	Total		MA		CH		I		II		MA		CH		MA		CH	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
PERLIS	1	—	1	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—
KEDAH	17	1	5	1	10	—	3	—	14	1	1	—	2	—	4	1	8	—
PENANG AND PROVINCE WELLESLEY ..	50	3	8	—	38	3	13	1	37	2	—	—	11	1	8	—	27	2
PERAK	75	11	18	—	41	7	20	2	55	9	3	—	11	2	15	—	30	5
SELANGOR	43	8	11	1	22	1	2	1	41	7	—	—	2	—	11	1	20	1
NEGRI SEMBILAN	30	4	13	1	9	2	5	—	25	4	1	—	3	—	12	1	6	2
MALACCA	14	—	5	—	8	—	1	—	13	—	—	—	1	—	5	—	7	—
JOHORE	25	3	8	—	15	3	3	—	22	3	—	—	3	—	8	—	12	3
PAHANG	26	—	8	—	17	—	1	—	25	—	—	—	1	—	8	—	16	—
TRENGGANU	1	—	1	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—
KELANTAN	11	—	11	—	—	—	1	—	10	—	1	—	—	—	10	—	—	—
TOTAL	293	30	89	3	160	16	49	4	244	26	6	—	34	3	83	3	126	13
																		35
																		10

M = Male; F = Female; MA = Malay; CH = Chinese; IN = Indian.

APPENDIX III

AREAS UNDER VARIOUS AGRICULTURAL CROPS

	(acres)	1959
Rubber		3,520,000
Oil Palm		124,000
Coconut		515,000
Padi (Rice)—All types		924,230
	Total ...	5,083,230*

FOOD CROPS:

Tapioca	34,240
Sweet Potato	23,510
Sago	6,390
Sugar Cane	2,600
Groundnut	4,420
Maize	10,710
Yam	1,570
Colocasia	4,660
Water Melon†	4,170
Soya Bean	80
Pulses	500
Pumpkin	600
Cucumber	600
Other Market Garden	20,890

Total Food Crops ... 114,940

FRUITS:

Pineapple	43,540
Banana	64,430
Papaya	1,090
Cashew Nut	1,580
Durian	35,400
Rambutan	24,480
Mangosteen	8,740
Citrus Fruits	8,990
Mango	2,700
Chiku	2,000
Duku	7,020
Rambai	2,940
Chempedak	3,800
Jack Fruit	1,750
Other Fruits	6,200

Total Fruits ... 214,660

* Estimated figure only, as no accurate figures are available for smallholding acreages of rubber. For each year the smallholding acreage has been estimated as 1,500,000 acres.

† Water melon, separately shown for 1958 (previously in "Other Market Garden") instead of Ragi (now in "other Market Garden").

APPENDIX III—(cont.)

AREAS UNDER VARIOUS AGRICULTURAL CROPS—(cont.)

	(acres)	1959
SPICES :		
Arecanut		35,680
Chillies		3,900
Pepper		630
Ginger		1,240
Sireh		2,820
Nutmeg		100
Cloves		240
Turmeric		910
Total Spices	...	45,520
MISCELLANEOUS :		
Tea		11,000
Coffee		15,340
Cacao		1,530
Tobacco		4,620
Derris		670
Nipah		32,100
Gambier		670
Kapok		1,360
Ipecacuanha		5
Patchouli		6
Citronella		17
Gutta Percha		3,820
Manila Hemp		520
Other Miscellaneous		220
Total Miscellaneous	...	71,878
TOTAL ALL CROPS	...	5,530,228*

* Estimated figure only, as no accurate figures are available for smallholding acreages of rubber. For each year the smallholding acreage has been estimated as 1,500,000 acres.

